

6-1960

## Farm & Home Science Vol. 21 No. 2, June 1960

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### Recommended Citation

(1960) "Farm & Home Science Vol. 21 No. 2, June 1960," *Utah Science*: Vol. 21 : No. 2 , Article 1.  
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# Farm and Home SCIENCE

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Vol. 21, No. 2

June 1960

UTAH STATE UNIVERSITY • LOGAN • AGRICULTURAL EXPERIMENT STATION





Annual Canterbury bells planted August 12 and August 23.

MR. RIETHMANN has charge of the experimental work in floriculture. Most of the tests are conducted at the Experimental Farm in Farmington. This article supplements the article on overwintering in the September 1959 issue of Farm and Home Science.

OTTO RIETHMANN

Time of planting is important in

# OVERWINTERING ANNUAL FLOWERS



Above, biennial Canterbury bells, *Campanula medium*, planted July 31 and August 12. Flower stocks are numerous on those planted July 31 while only a few stocks are present on those planted August 12

Right, Chinese forget-me-nots planted August 12 and biennial Canterbury bells planted August 23. The Canterbury bells have only produced leaf rosettes the first season. No flower stocks were produced until the following year







Snapdragon, Magic Wand, planted July 31 and August 23

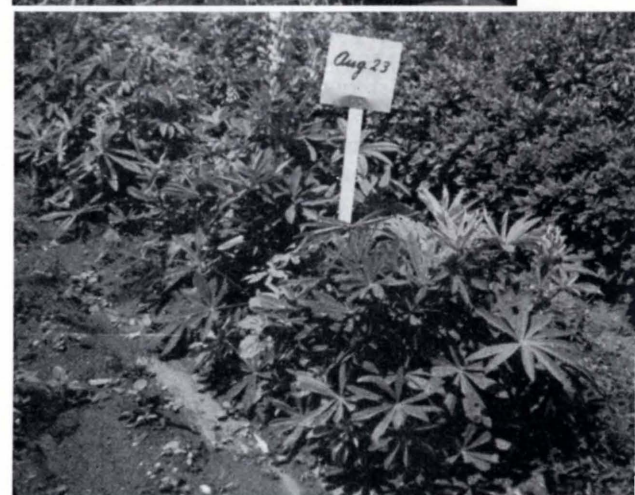
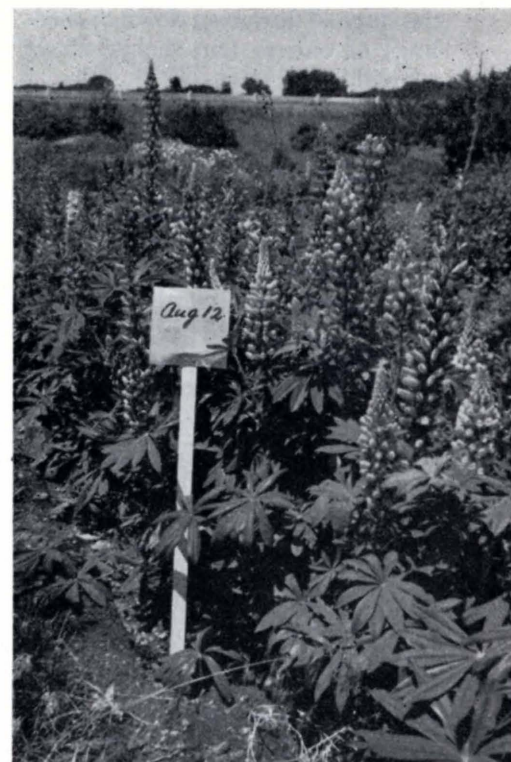
FALL planting of grain, some vegetables, and biennial flowers is an old practice. Some annual flowers are planted in the fall in southern gardens. In our Intermountain Area fall planting for overwintering is little practiced except with pansy and in a few cases with other biennials such as sweet-william, hollyhock, and larkspur. This method of planting flowers can be most rewarding and provide more colorful spring and early summer gardens.

According to results of our experiments, fall planting can also be used for certain annual and short lived or tender perennial flowers. It is not unusual that snapdragons growing in protected places in our area bloom for one or more years as perennials, producing flowers in large numbers from overwintered stock plants. However, such hardiness by snapdragons is not the com-

mon rule. Winter hardiness of tender herbaceous plants is more commonly observed in the seedling stage than in old mature stock plants. Such observations encouraged us to study the possibility of overwintering certain annual and other flowers by bringing them through the winter in different stages of development.

We know little about what makes a plant winter hardy, otherwise, we would probably be able to increase such hardiness artificially, but according to experimental results there exists a remarkable difference in winter hardiness in plants in different stages of maturity and this can profitably be made useful in overwintering certain annual flowers.

The different maturities of the seedlings for overwintering were obtained from planting at different dates. This produced plants from



Above, lupine, Russel hybrid, planted August 12 and August 23



Left, candytuft, Iceberg, planted August 12 and August 23. Plants from the August 12 seeding were too mature and did not overwinter well



the stage of flowering down to seedlings of one to two inches above ground.

### *Correct planting time influences flowering*

The studies with overwintering annual flowers have been enlarged by including biennial and perennial flowers. Among all types correct timing of the planting has much influence on quality, size of the plants, and quantity of flowers.

Short living, tender, or easily diseased perennials such as carnation, delphinium, gloriosa daisy, and lupine have excellent possibilities for direct outdoor sowing in the fall for overwintering, resulting in vigorous, healthy, and productive plants in the following year. Hybrid delphiniums often diseased or damaged by wind can preferably be planted in the fall.

Some of our annual flowers develop a long lasting and good quality crop only in cool seasons, but quit blooming, mature seed, or are mildew susceptible in hot weather. Calendulas, candytuft, stocks, and larkspur belong in this group. Spring planting of such crops delays vegetative growth and flowering often too far into the hot season. Annuals planted in the fall bloom three to six weeks earlier depending on the kind and variety.

### *Method of planting*

The land selected for fall planting should be well cultivated and fertilized to assure good growth of the seedlings in the fall as well as in the following spring. Where a weed problem exists, spraying with a weed killer two to three weeks before planting is both safe and profitable. Preparation of the land two to three weeks before planting and permitting it to remain fallow will allow many weed seed in the upper region of the soil to germinate. These small weeds can then be easily killed before planting. By this method little disturbance of the soil at planting time is required, thus preventing new weed seed from coming close to the soil sur-

Table 1. Percent survivals in spring from overwintered flowers at each planting date

Variety	July 31	Aug. 12	Aug. 24	Sept. 4
*Aster	3	8	0	0
*Campanula medium (biennial Canterbury bell)	85	97	56	19
**Candytuft 1956-57	40	50	75	10
" 1958-59	1/3	1 1/2	8	65
Canterbury bells, annual	42	72	60	21
Carnation	80	72	73	63
Catananche coerulea	—	80	100	82
*Centaurea (bachelor's button)	60	88	100	88
Centaurea suaveolens	—	10	60	20
*Cheiranthus allioni (Siberian wallflower)	100	100	100	97
Chinese forget-me-not (Blanch Burpee)	87	80	77	8
Delphinium, annual	50	50	50	0
English daisy	65	50	50	37
Feverfew	93	90	55	1
Foxglove	50	50	10	0
*Gloriosa daisy	95	99	100	92
*Hollyhock	100	100	100	100
Larkspur	100	100	100	100
*Lupine	42	42	70	63
Pansy	100	100	75	30
Rudbeckia, Starlight	50	50	75	50
*Scabiosa, annual	65	67	58	45
**Snapdragon	65	59	32	0
**Stocks	0	few	few	0
Sweetpea	0	0	0	0
Sweet-william	100	100	100	25

\*Average of 2 years.

\*\*Average of 3 years.

face where they can germinate. A plot thick with weeds is a hazard to small flower seedlings and it can make their overwintering questionable.

The seed should be planted closer than for spring planting. A close stand of the seedlings seems to have more chance of survival from the dangers of winter and early spring. This insures a close stand of plants after part of them are winter killed. The planting depth of the seed must be according to its size. Foxglove, feverfew, snapdragon, and some other flowers have fine seed which should only be pressed in the soil or lightly covered. Mixtures of light soil conditioner such as vermiculite, peatmoss, sawdust, or sand with soil for covering the seed are recommended, especially where the soil has the tendency to form hard crusts after watering.

(Continued on page 60)

## FARM AND HOME SCIENCE

Published Quarterly  
by the

Agricultural Experiment Station  
Division of Agricultural Sciences  
Utah State University of  
Agriculture and Applied Science  
Logan, Utah

Daryl Chase, President

W. H. Bennett, Director  
Division of Agricultural Sciences

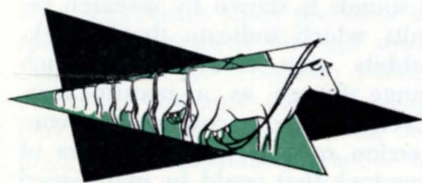
D. W. Thorne, Director  
Agricultural Experiment Station

Gladys L. Harrison, Editor



# Supply-consumption balance of market milk in Utah

R. A. CHRISTENSEN



WITH sales of fluid milk and cream by Utah plants increasing about 5 percent per year and plant receipts of market milk increasing about 8 percent per year, the market milk industry has gone from a favorable supply-consumption balance in 1948 to one of considerable excess supply. This trend indicates a more than ample supply of market milk in the foreseeable future for Utah's growing population. If producers and handlers do not take the steps necessary to bring the rates of increase in plant receipts and fluid sales into balance, the market milk industry will be faced with problems of price-depressing surpluses in the future, while manufacturing

plants cope with problems of dwindling supplies. These are the conclusions from a recent study on the supply and use of market milk in Utah.



## Shipments are outrunning population

In 1948, when the population was 653,000, Utah producers shipped 199 million pounds of market milk to plants located in both Utah and Nevada (table 1). By 1957 shipments had increased 101 percent or about 8 percent per year and population had increased 29 percent or about 3 percent per year (figure 1). During this same period shipments of manufacturing milk by Utah producers decreased from 307 to 243 million pounds.

Shipments of market milk by Utah producers amounted to 305 pounds for each person living in the state in 1948. This amount was adequate to supply the demand for fluid milk and cream. By 1957 shipments had increased to 477 pounds per capita — a 56 percent increase. During this period per capita consumption of fluid milk and cream remained about the same in the United States (table 1) and probably also in Utah. Thus it can be seen that increased shipments of market milk have greatly exceeded increased consumer demand in recent years. Not all this extra milk has gone into manufacturing, however. An increasing amount has been sold in neighboring states for fluid use.



## Shipments exceed fluid consumption in most areas

The state was divided into four sections in order to study supply-consumption balance by areas (figure 2). In 1957 producers in the northern, central, and southwestern areas shipped more market milk than consumers bought back as fluid milk, but in the southeastern area consumers bought more than was shipped. Shipments exceeded purchases most in the northern area where producers shipped 81 million pounds of market milk and consumers bought 15 million pounds (table 2). Shipments even exceeded purchases by a considerable margin in the central area which contains about 79 percent of Utah's population and where about 84 percent of plant sales in the state were made in 1957.

There were some counties which did not ship as much as they purchased. This was true for heavily populated Salt Lake County where 39 million pounds of market milk were shipped by producers and 114 million pounds of fluid milk and cream were purchased by consumers. Purchases also exceeded shipments in Garfield, Grand, Kane, Rich, and Wayne Counties. Shipments exceeded purchases most in Cache County where producers shipped 56 million pounds of mar-

(Continued on page 58)

Table 1. Trends in Utah population, shipments of market milk and manufacturing milk to plants by Utah producers, and fluid milk and cream per capita consumption in the U. S., 1948, 1952, and 1957

Item	1948	1952	1957
Utah population, thousands*	653	730	840
Shipments of market milk, Utah, million pounds	199	295	401
Shipments of mfg. milk, Utah, million pounds†	307	262	243
Per capita consumption of fluid milk and cream, U. S., pounds†	355	352	350

\*U. S. Bureau of the Census

†U. S. Agricultural Marketing Service

DR. RONDO A. CHRISTENSEN is assistant professor of agricultural economics. This study is reported in greater detail in Utah Resources Series 2, Supply and use of market milk in Utah.



# Seven jackrabbits

**Jackrabbits more destructive to range than livestock because they graze closer and for a longer season**



Fig. 1. The blacktailed jackrabbit is an important factor in the management of Utah's rangeland

How many ewes do you lose each year? It wouldn't be too difficult to estimate the number lost to poisonous plants, predators, or disease. But, you probably haven't seriously considered the loss that occurs because range forage is pirated by other animals.

Do you lose one ewe for every seven jackrabbits you see? That this question is not as absurd as it sounds is shown by research results which indicate that 7 jackrabbits may consume as much range forage as a mature ewe. Even if a more conservative conversion ratio is used, numbers of livestock that could be maintained on forage used by jackrabbits are amazing.

## *Where the jackrabbit is found*

The common blacktailed jackrabbit (fig. 1) is probably the most abundant of the smaller mammals of Utah. It is found in the lower edge of the ponderosa pine zone but is most abundant in the juniper-pinyon and lower elevation vegetation zones except in the Uinta Basin. Apparently the high mountains and the Green and Colorado Rivers constitute a barrier to the spread of jackrabbits into this basin.

DR. DuWAYNE L. GOODWIN is assistant professor of range management. He has been a member of the staff since 1955.

Fig. 4. Jackrabbits use different plants at different seasons. Here heavy, persistent use of Indian ricegrass has resulted in death of many plants. Winterfat will be used as winter food



# equal one ewe

## *Jackrabbits cause loss of crops and forage*

Wherever they are found, jackrabbits have ultimately become a pest. Since settlement began, there have been reports of jackrabbit depredations that have resulted in loss of cultivated crops. In 1887 farmers in Beaver County reported that their entire crop was lost to rabbits.

Losses on farm lands still occur. They are particularly heavy in winter wheat in the spring of the year. However, a second area of loss which has been overlooked in the past is the loss of range forage. Such losses have assumed considerable importance since practices of range improvement through seeding of grass have become widely accepted. Because costs of seed-bed preparation and planting are high, it is a customary practice to seed only the most promising lands. This results in a comparatively small seeded area surrounded by a relatively large unseeded area. The seeded area serves as a source of easily available food, while the unseeded brush area supplies the home and the protection for the rabbits. The result is high concentrations of jackrabbits whenever a seeding is made.

Although it has not been definitely established, there are strong indications that a high jackrabbit

population can be the factor which determines the success or failure of this range improvement practice. In fact, it is probable that certain past failures in attempts at seeding would have been successful if jackrabbits had been controlled and that areas where seeding has failed presumably as a result of poor management actually were "eaten out" by rabbits. Wells Robins at Scipio has had experience of this type. He has a small patch of crested wheatgrass that was planted to provide pasture for his cows, but rabbits keep it so closely mowed that he has finally contributed it to the jackrabbits. He also had a dryland planting of intermediate wheatgrass which was completely destroyed. Investigations in New Mexico revealed that jackrabbits may consume as much as 99.4 percent of the perennial grass forage produced on native desert grassland ranges.

## *Research to determine jackrabbit effects*

Since 1956 the Utah Station has investigated the effect of jackrabbits on native range plants. The findings have been surprising.

To determine how much forage a jackrabbit would eat, pens were erected on native and seeded ranges (fig. 2). In each of eight pens a single captive jackrabbit was

D. L. GOODWIN

allowed to graze for four days. By use of paired clip-plots located inside and outside the pens, the amount of forage taken by jackrabbits was determined. The amount used was then compared with the quantity considered ample for a mature cow. From these studies it appeared that 35 really hungry but happy jackrabbits could use as much forage as one cow. The greatest spread was 137 jackrabbits to equal one cow. If the ratio of 5 sheep equals 1 cow is accepted, 7 to 27 jackrabbits could eat as much as one ewe. Later studies in which field pens and barn feeding were compared have pointed to 15 to 20 jackrabbits as equal to one ewe in forage consumption.

## *Numbers of jackrabbits on rangeland*

The full importance of this forage use cannot be realized unless we have some idea of the numbers of jackrabbits on the open range. Information of this type has been obtained from the Oneida County Rabbit Association (Idaho) which has—since January 16, 1960—conducted weekly rabbit drives in various areas between Snowville, Utah, and Holbrook, Idaho (fig. 3). In five drives, each of which covered about one section of land,

(Continued on page 51)

Fig. 2. Jackrabbits in pens were used to study quantity of forage consumed

Fig. 3. Jackrabbit drives are sources of approximate information about numbers of jackrabbits

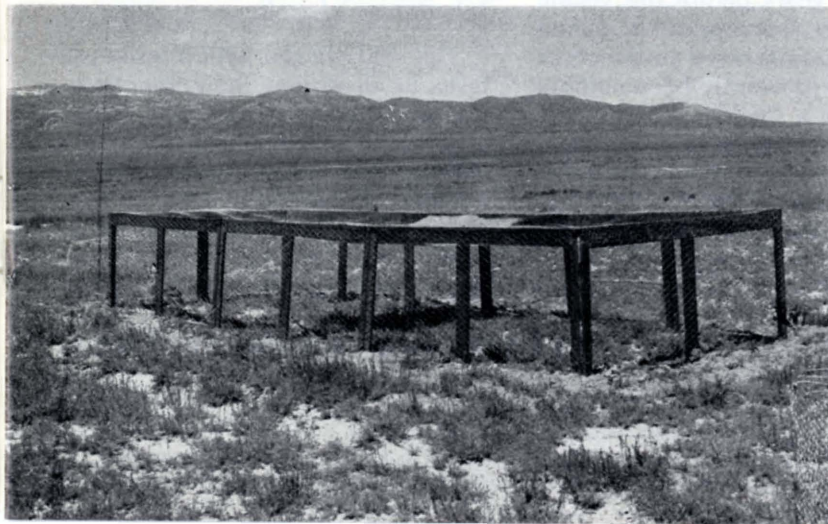






Fig. 1. Photographs of flies showing the tumorous head trait

CANCER involves the basic mysteries of growth and the intricate machinery of the living cell. Its causes and control are being approached from countless angles by many scientists in research laboratories throughout the United States. One of the approaches studied at Utah State is that of the influence of heredity on tumorous growths. These studies are being made on the fruit fly, *Drosophila*

o

DR. ELTON J. GARDNER is professor of zoology and an outstanding teacher and researcher in genetics. The research reported here is financed in part by funds from the American Cancer Society, the Damon Runyon Memorial Fund, and the National Institutes of Health.

*melanogaster*. Flies carrying the tumorous growths on the head (fig. 1) were first obtained from the Genetics Laboratory of the University of Texas several years ago.

Ancestors of the tumorous head flies had been collected from their native habitat in Mexico and maintained in the Texas laboratory for at least four years before the visible abnormality first appeared. When the trait was observed in the stock which had previously been nothing more than a "wild" collection, it was presumed to have arisen from a spontaneous mutation. The genetic mechanism of the new trait was not thoroughly investigated until the present study was initiated in Utah. One aspect of the problem

# Tumorous head genes in fly populations

A study of how abnormal growths are inherited

ELTON J. GARDNER

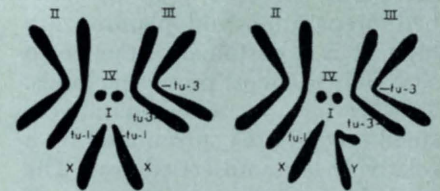


Fig. 2. Diagram of chromosomes of the fruit fly, *DROSOPHILA MELANOGASTER*, as they appear in dividing cells. Left, chromosomes from female cell; right from male cell. Locations of the two genes (*tu-3* and *tu-1*) associated with the tumorous head trait are indicated.

was to explain how and when the genes associated with the abnormality originated.

## Inheritance of trait

The study began with a series of tests to determine how the trait was inherited. It was found to be a complex genetic mechanism involving two major genes and a number of modifiers. One of the major genes (*tu-3*) proved to be a basic gene that was required for any expression. This gene was lo-



cated in the large third chromosome (fig. 2) by a method involving the substitution of chromosomes carrying dominant (marker) genes carried in laboratory stocks. Its position in the third chromosome was established from linkage studies at 59 map units from one end of the chromosome. From further genetic studies the gene *tu-3* was found to be semidominant, that is, in the presence of one member of the pair a slight expression of the trait occurs. When both members of the pair of third chromosomes carry this gene (but the other gene associated with the trait is not present) about one percent, or less, of the flies express the trait.

The other gene (*tu-1*) is sex-

were mated with males from most wild or laboratory stocks, about 35 percent of the progeny were abnormal. From the reciprocal cross between wild females and tumorous head males one percent or less of the progeny were abnormal. This was the evidence from which the maternal effect was first suggested.

#### Transfer of maternal effect

Last summer USU researchers succeeded in transferring the maternal effect by preparing an extract from the bodies of tumorous head females and injecting it into wild females. When the wild females into which the extract had

#### DEFINITION OF TERMS

- allele—one member of a pair of genes
- chromosome—the cell structure which carries the genes
- dominant—a gene that expresses itself at the expense of its partner gene
- gene—an agent of inheritance
- genetics—study of heredity and variation
- heterozygous pair—a pair of unlike genes
- homozygous pair—a pair of like genes
- linkage—the tendency for genes to enter the gametes together because they are in the same chromosome
- map units—units on the chromosome map. One unit corresponds to 1 percent of crossing over
- mutation—change in a gene
- recessive—a gene that can be hidden by a dominant partner

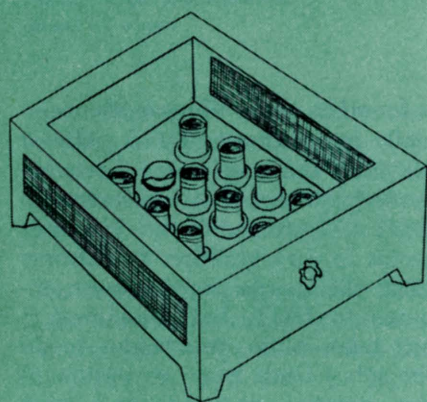


Fig. 3. Population cage for fruit flies constructed with glass top and wire screen sides. The box is 12 x 18 inches and 7 inches deep. Food jars in the bottom are placed on corks which can be removed from the bottom to replace jars

linked, that is, it is located in the first chromosome, the one that is also associated with sex determination. This gene is completely recessive, both members of the pair are required for any expression. Furthermore, this gene is expressed only through the mother and thus produces a "maternal effect." When the mother carries *tu-1* in each member of the pair of first chromosomes and one *tu-3* gene is passed on to the offspring from either the mother or father fly, about 35 percent of the progeny express the trait. When tumorous head females

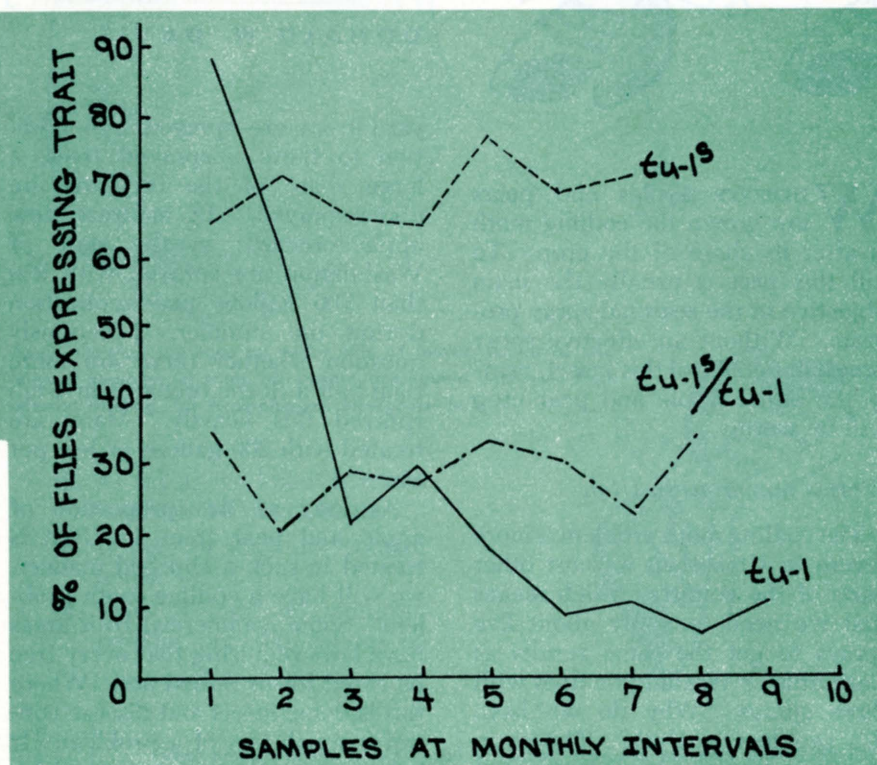


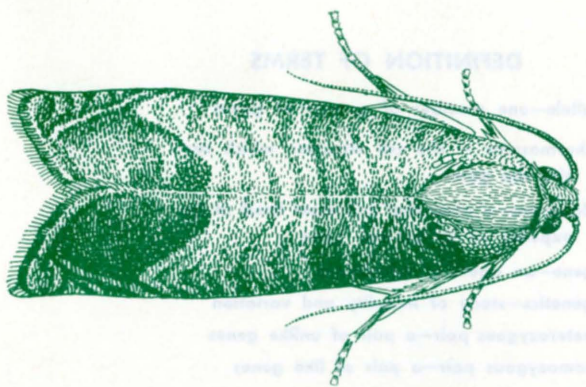
Fig. 4. Graph showing the percent of flies with the tumorous head trait based on samples taken from population cages 1, 2, and 3 at monthly intervals. Solid line, population from cage 1 started with single pair of tumorous head flies carrying allele *tu-1*; line with dots and dashes, from cage 2 started from a cross between flies with *tu-1<sup>s</sup>* and *tu-1* alleles; broken line at top, from cage 3 with tumorous head flies in which allele *tu-1<sup>s</sup>* was substituted for *tu-1*

been injected were mated with tumorous head males about 20 percent of the progeny were abnormal. This indicated that a substance produced in the body of the female

was the causative agent for the maternal effect. Experiments are now in progress to determine the chemical nature of the substance

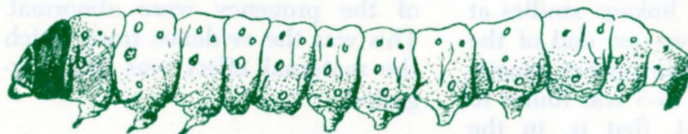
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Codling moth adult

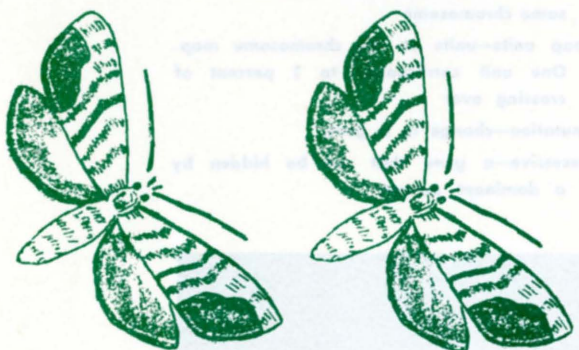
**Moths will continue to be pests until back yard trees are sprayed or eliminated**



Codling moth larvae



Pupa



## *SEVERITY of the Codling Moth Problem in Utah*

DONALD W. DAVIS

**W**HEREVER apples and pears are grown the codling moth is after its share of the crop. To kill this pest is usually the main objective in the seasonal spray program. Without an effective spray program to control this insect, nearly the entire apple and pear crop will be wormy.

### *Worms numerous in Utah*

The codling moth problem is more severe in Utah than in most other parts of the country, which means that we need to apply about five sprays to get the same results as California or Washington does with three sprays. Why do we have this problem in Utah? The main reason is that we have brought it on ourselves. There are entirely too many unsprayed and poorly sprayed apple and pear trees. Almost every home has a few trees in the back yard which are ideal places for the worms to grow and multiply. Often these trees produce little or no fruit. Few back-

yard trees are sprayed. In addition to these unsprayed trees, a large share of the orchards are under-sprayed. In contrast, few apple orchards in the state of Washington are sprayed with less than 700 gallons per application during the summer. I seriously question whether there are more than half a dozen orchards in Utah sprayed this heavily. Many are treated with 200 gallons or less per acre.

As long as this proportion of apple and pear trees in Utah is treated in such a slipshod manner, we will have a codling moth problem. Some commercial fruit areas have laws requiring that every tree be cared for or pulled out. Where this is done, insect and disease control is much less of a problem. It has come to the point now where we must decide whether we are raising commercial fruit or healthy codling moths. Can growers in Utah profitably spray five or six times a season to get the control that others get with three or four applications?

is found in the codling moth, especially in relation to DDT. Almost all fruit growing states have recorded instances of resistance to DDT. The extent of the resistance seems to vary greatly. In extreme cases the worms seem almost immune to DDT, but sometimes it just takes more insecticides to do the job. Utah is no exception to this general situation, and most commercial fruit growing areas have examples of some degree of codling moth resistance to DDT. Our opinion is that the effective period of use with DDT for codling moth control will soon end in most of Utah. Many growers have already turned to other materials.

It is false to assume that any time insect control fails it is an example of resistance. Poor timing of sprays, inadequate spray coverage, too little material, poor equipment, adverse weather during or after spraying, and many other factors can contribute to unsatisfactory insect control. Resistance is only one of the causes of poor insect control.

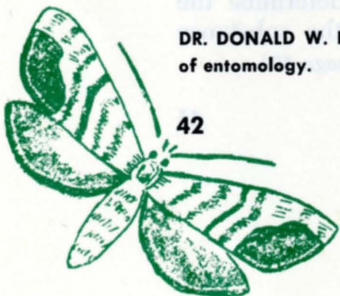
### *Resistance to insecticides*

One of the best known instances of insect resistance to insecticides

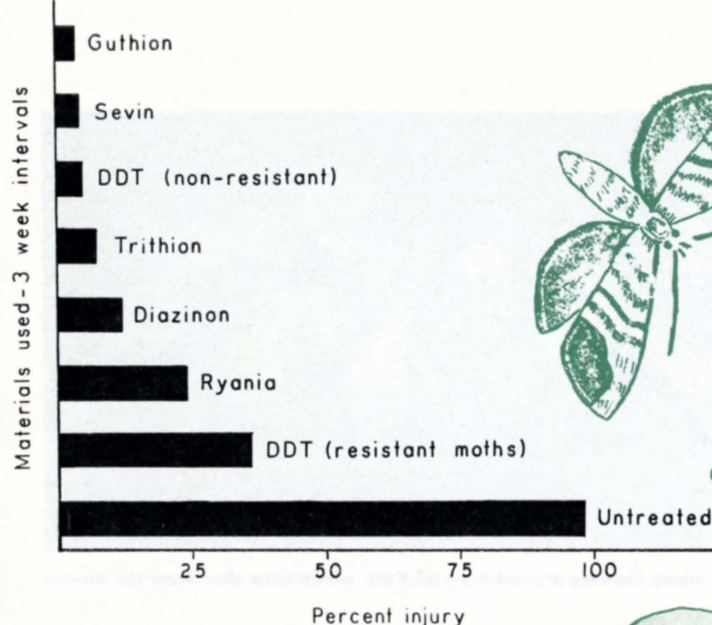
### *Sprays to use in place of DDT*

Because of the many failures with DDT in codling moth control,

DR. DONALD W. DAVIS is associate professor of entomology.







Codling moth injury to apples when various chemicals were used, 1956-1959. Injuries include worms, stings, and windfalls caused by worms

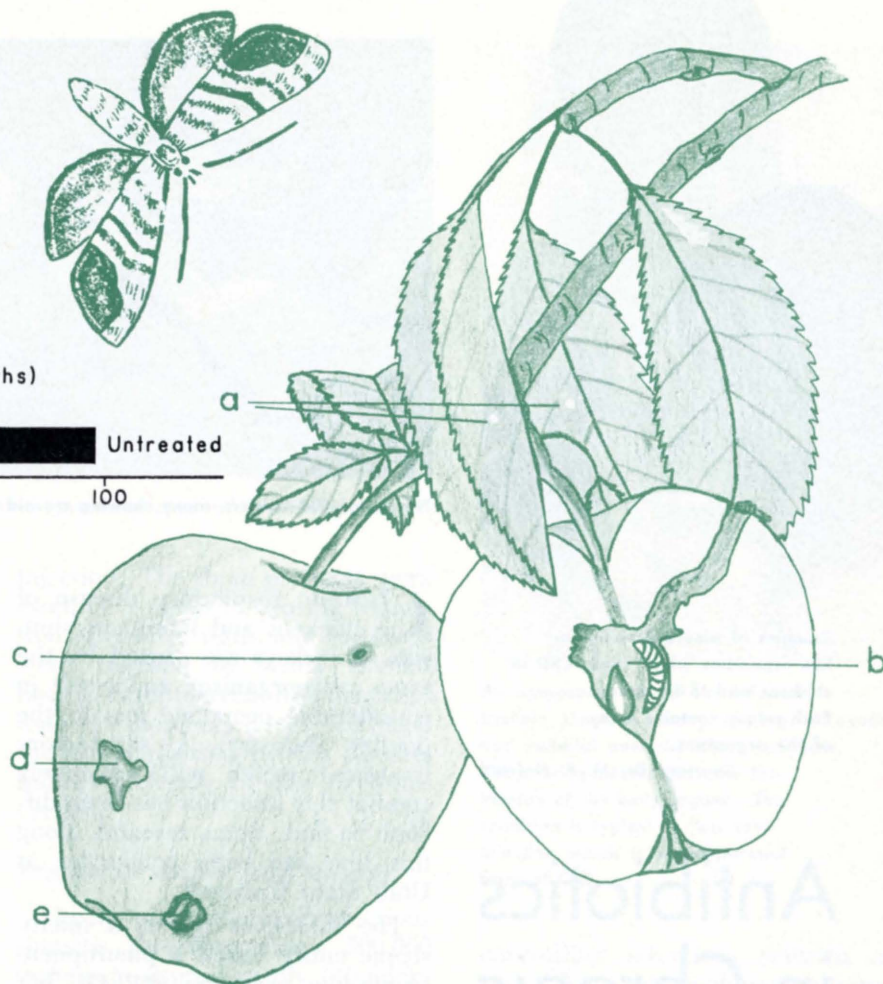
entomologists in many states are working out alternative spray programs. This problem has occupied a large share of the time spent on research for the control of fruit tree insects in Utah.

In cases where resistance to DDT is not severe, an organic phosphate material such as parathion or malathion may be added to the DDT. This practice will generally stretch the use of DDT for an additional season or two. It is not the answer, however, where a severe resistance problem exists. We know from past experience that once an insect is resistant to an insecticide, it quickly becomes resistant to related materials. Most of the current studies on codling moth control are directed toward the use of insecticides which are unrelated to DDT.

Where known resistance to DDT exists, a number of materials have given results superior to DDT. Almost without exception two insecticides have been outstanding. These are Guthion and Sevin. There are several points to remember when using these two materials.

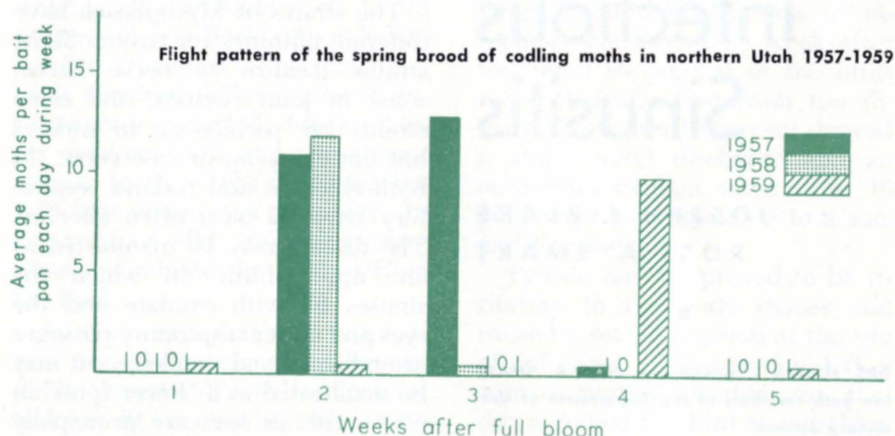
#### Guthion:

1. Is toxic to man.

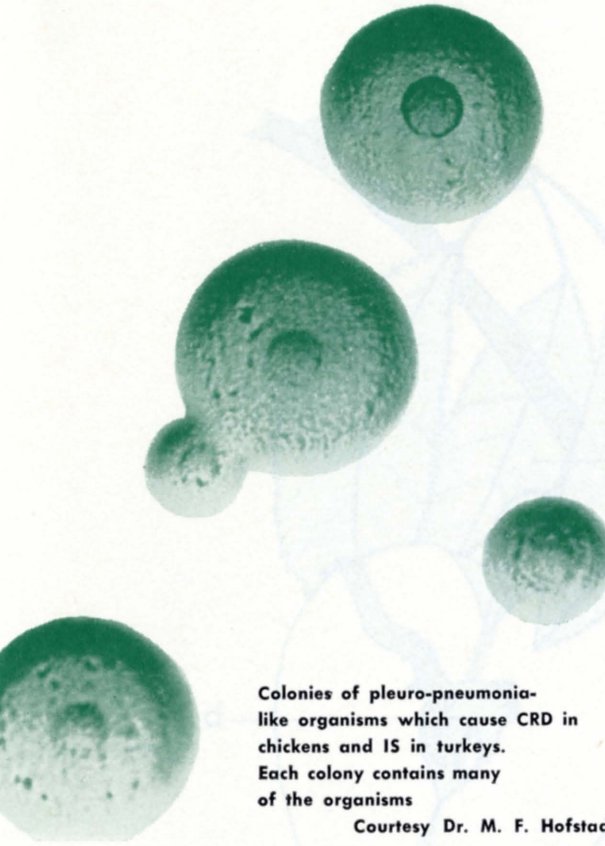


Apple showing (a) eggs on under side of leaves, (b) larva and internal damage, (c) sting, (d) surface breakdown and frass from internal feeding, (e) frass-plugged emergence hole

2. As far as we know it is not injurious to plant tissue.
  3. It may or may not control mites.
  4. Two pounds of wettable powder per 100 gallons of
- (Continued on page 61)







Colonies of pleuro-pneumonia-like organisms which cause CRD in chickens and IS in turkeys. Each colony contains many of the organisms

Courtesy Dr. M. F. Hofstad

# Antibiotics in Chronic Respiratory Disease and Infectious Sinusitis

JOSEPH T. BLAKE  
ROSS A. SMART

DRS. JOSEPH T. BLAKE and ROSS A. SMART  
are both members of the Department of Veterinary Science.



Nine week old broilers, many showing morbid signs of CRD; others have died from the disease

CHRONIC respiratory disease of chickens and infectious sinusitis of turkeys are caused by the same microorganism, and result in considerable economic loss to the poultry industry. A satisfactory treatment which will effectively combat this infection has been difficult to find. Some research along this line has been conducted at Utah State University.

The infectious agent, a microscopic entity called a pleuropneumonia-like organism (PPLO), has the scientific name of *Mycoplasma*. The organism possesses distinctive biochemical and cultural properties which result in its responding differently to therapeutic agents than do either viruses or bacteria. Even though *Mycoplasma* do not have a true cell membrane and are, therefore, fragile if placed under physical stresses, paradoxically, they are difficult to destroy once they have invaded the animal body.

The strains of *Mycoplasma* have different affinities for tissues. Some strains localize in nerve tissue, some in joint cavities, and some strains are pathogenic to turkeys but not chickens, or vice versa. In both chickens and turkeys respiratory tissue is most often affected. The disease may be manifested as an "upper form" in which the sinuses fill with exudate and the eyes and upper respiratory passages are inflamed and swollen, or it may be manifested as a "lower form" in which the air sacs are principally

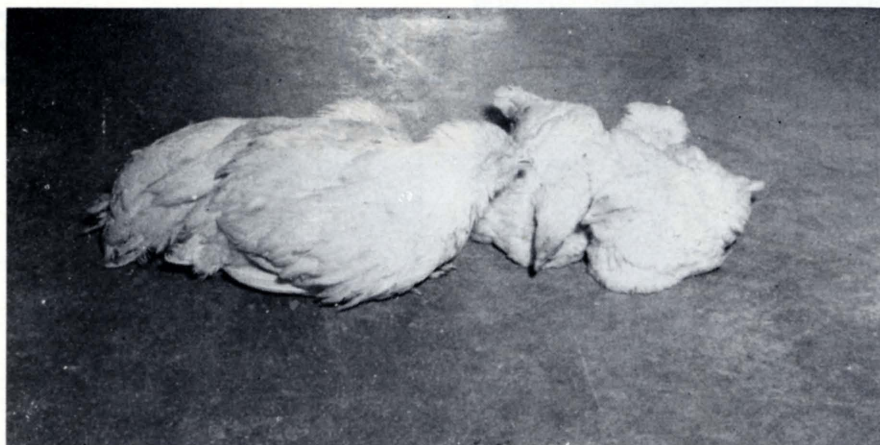
affected. The disease is a counterpart of the human cold in its effect on the upper respiratory passages. If bacterial invasion occurs there may also be massive coating of heart and liver with exudative material. In many birds the infection is widespread and will be both in the upper and in the lower respiratory organs. Affected chickens will go off egg production, appear depressed, and will show the eye and sinus lesions mentioned above. In turkeys the most common symptom is sinus swelling.

Method of treatment will vary, depending upon how extensive the infection is in a given flock. There is no vaccine to prevent the disease. In an outbreak, antibiotics are the only agents which have specific value. They are not entirely satisfactory, but will, when applied properly, temporarily alleviate the symptoms and will improve the performance of the flock. The importance of sanitation and good management, with medication as an adjunct, cannot be overemphasized. Without proper sanitation and good management any benefit derived from medication will be short.

## *Treatment trials with chickens at USU*

The type of antibiotic preparation to use and the method of administration recommended vary with the severity of infection in a





Malaise and conjunctivitis are the most prominent symptoms observed in these broilers

flock. If the infection is deep-seated, has extended into the air sacs, and is complicated by secondary bacterial invasion of the body cavities, little can be done to eliminate the disease from the flock.

In one experimental trial, in which three different antibiotic preparations were administered to laying hens having a chronic, diffuse infection, none of the products were able to restore the health of the flock. The birds did improve in appearance and in egg production temporarily, and treatment was of some value. The antibiotics employed were (a) streptomycin-dihydrostreptomycin, (b) erythromycin and (c) oxytetracycline. They were injectable preparations and were administered three times per bird. There was little superiority of one product over another. However, birds receiving oxytetracycline increased their egg production approximately 5 percent in comparison to control birds or the birds in the other treatment groups.

Better results are realized in restoring birds to a normal state of health if the infection is treated early. In another trial, young, growing chickens were experimentally infected with CRD. In an early stage of the disease these birds were treated with the same three antibiotic preparations mentioned above. They received weekly treatments, for four weeks, at the dosages recommended by the manufacturers of the products. Treatment was by intramuscular

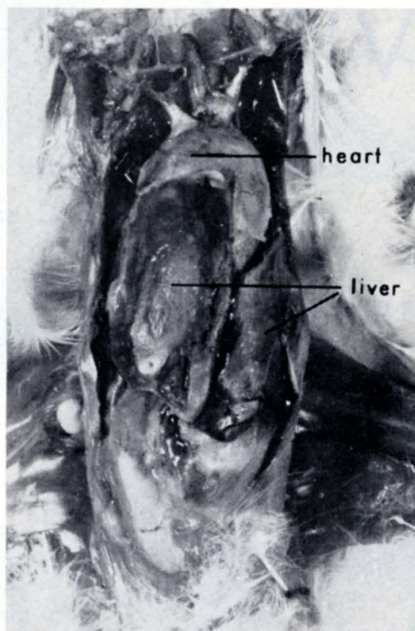
injection. The three products were essentially equal in causing regression of clinical signs, and the birds were restored to nearly normal health. Streptomycin-dihydrostreptomycin most effectively reduced the lesions caused by the disease, followed closely by the oxytetracycline.

#### *Treatment studies with turkeys*

During an epizootic of infectious sinusitis involving about 500,000 turkeys in approximately 140 flocks in a heavily populated turkey area, the benefits of antibiotic treatment were demonstrated.

A mixture of oxytetracycline, 6 to 8 milligrams per pound body weight, and of streptomycin, 15 milligrams per pound of body weight was given parenterally. This treatment appreciably reduced the outward signs of the disease, mortality, and market condemnations and increased the average market weight. Approximately 65 to 75 percent of one flock responded to the first treatment. The remaining birds required daily treatment until response occurred. Flock relapses were common, and retreatment at four to six weeks following the initial treatment was necessary. In no instance did treatment completely eliminate the disease from the flock.

Another experimental preparation of erythromycin was administered parenterally to a flock of turkeys. It was not as effective in



An autopsy of one of the infected broilers shows a heavy coating of exudative material over the heart and liver. The coating nearly obscures the identity of the body organs. This condition is typical of "air sac" infection which is a complicated form of CRD

controlling infectious sinusitis as was the oxytetracycline-streptomycin combination.

In some cases an erythromycin-arsanilic acid preparation in the mash was beneficial in helping control mortality and increase feed consumption of infected flocks.

The value of an experimental drug, tylosin tartrate, was investigated. Approximately 10 milligrams of this product per pound body weight, were administered intramuscularly to a group of turkeys which exhibited symptoms of infectious sinusitis. One week after treatment 90 percent of the birds were clinically free from the disease. The other 10 percent showed a slight nasal discharge and an occasional swollen sinus. The 10 percent group responded to a second treatment.

Tylosin tartrate proved to be irritating to the body tissues and caused a severe reaction at the site of injection. This reaction left a scar, or partially healed scar, that down-graded the bird at slaughter.



# VITAMIN ENRICHED APPLE

New product equal to citrus  
juice in vitamin C content

ROBERT K. GERBER  
D. K. SALUNKHE



Fig. 1. The volume of various fruit juices in 4 ounce glasses required to supply 30 milligrams of vitamin C.

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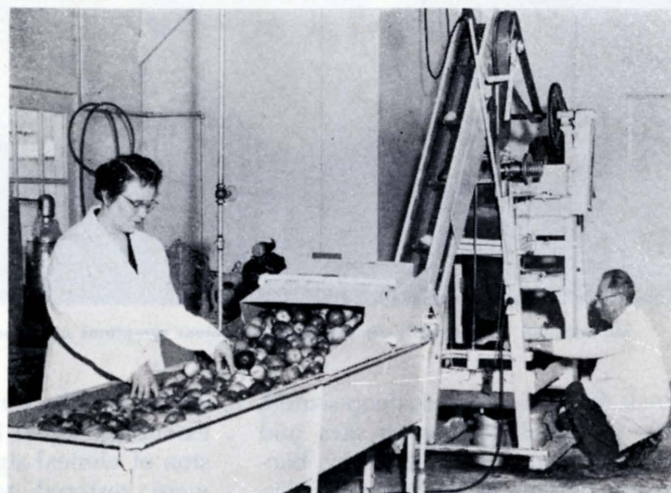


Fig. 2. General view of apple juice manufacturing. Note blend of varieties, washing and sorting operation; elevator, and grinder



ORANGE JUICE 2.4 ounces



GRAPEFRUIT JUICE 3.5 ounces



TOMATO JUICE 5.9 ounces



PINEAPPLE JUICE 8.7 ounces



CRANBERRY JUICE 11.3 ounces



RASPBERRY JUICE 12.7 ounces



GRAPE JUICE 42.5 ounces



APPLE JUICE 52.5 ounces

FOR many years, members of the Department of Horticulture at Utah State University have been able to convert small, misshapen, and even injured apples into a palatable delicious drink which has been called "cider" or "sweet cider." This has been made from a blend of apples — Jonathan, Rome Beauty, and Delicious varieties in equal proportions or their flavor equivalents (sugar-acid balance). Only firm ripe fruits are used, since immature or over-ripe ones lower the quality.

## Production of apple juice

The fruits are washed, sorted for decay, and pulverized in a grater or hammermill. Measured quantities of pulp are enclosed in heavy cloths — known as "cheeses" — and 5 or 6 are interspersed with slatted

boards and pressed at one time. A yield of approximately 3 gallons of juice per bushel of apples is obtained. The juice is placed in a storage tank at ambient temperature and the pectinase enzyme, Pectinol A, is stirred into it at the rate of 0.1-0.2 percent. The mixture is allowed to stand over night — usually 12 to 15 hours. At the end of this time, most of the small particles have settled to the bottom and the clear juice can be drawn from the top of the tank. Diatomaceous earth is added to the residue in the bottom of the tank to aid in filtering so that the rest of the juice can be salvaged.

## Flash-pasteurization of apple juice

The juice is then run through a flash-pasteurizer in which the

ROBERT K. GERBER is assistant professor and DR. D. K. SALUNKHE associate professor of horticulture. They are both studying problems in the preservation and processing of fruits and vegetables.



# JUICE



Fig. 3. Adding enzyme to aid in the clarification of the juice



Fig. 4. Above: Filtration of apple juice



Fig. 5. Left: Flash filtration of apple juice

Fig. 6. Right: Crushed apples, cheese, addition of vitamin C

temperature of the liquid is raised from 60°F. to 180°F. in 30 seconds. Warm, sterile bottles are filled with the hot juice and they are capped with sterile, rubber-ringed metal caps. The bottles are placed on their sides for five minutes and then stored in a vat of water at 150°F. until 20 are accumulated. Cold water is then introduced into the vat and the juice is cooled in a period of 30 minutes. The sequence of events in this juice manufacture is shown in figures 2, 3, 4, and 5.

## Composition of apple juice

This sweet cider has a composition approximately as follows: water 87.1 percent, protein 0.1 percent, ash 0.25 percent, total carbohydrate 12.5 percent, sugar 10.5 percent, malic acid 0.52 percent, and 50 calories per 100 grams.

Sweet cider is compared nutritionally with orange juice in units per 100 milliliters in table 1.

## Fortification of apple juice

The greatest difference between orange juice and apple juice is in the amount of vitamins A and C. In orange juice there are six times

more vitamin A and 2 1/2 to 350 (avg. 21) times the vitamin C as in sweet apple cider. The volumes of various non-fortified juices required to supply the 30 milligrams of vitamin C each day in a person's diet are shown in fig. 1.

In 1939, under the stress of war-time economy, experiments were started in Canada to determine the feasibility of fortifying sweet cider with ascorbic acid (vitamin C). Success was attained and a local drink was produced which contained as much vitamin C as orange juice. Thus, foreign exchange was conserved since it was no longer necessary to import citrus juices for an antiscorbutic part of the diet. For several years, this was the only kind of sweet cider sold commercially in Canada.

(Continued on page 63)



Fig. 7. Comparison in color of apple juice. Left: Regular apple cider — note dark color. Right: Fortified apple juice with ascorbic acid — note light color



# FENCE BUNK SILO—an efficient and economical way to store corn silage



Fig. 1. Detail of construction of fence bunk silo shows how the fence is constructed and the manner in which the plastic top cover is pulled down tight between the side plastic and the wire. When pulled down tight, a tight air seal is formed preventing side and top spoilage. All water from rain and snow drains through the fence to the outside of the silo. 2. Silo opened for feeding. The plastic cover is rolled back as the silage is fed out. Uncovering the silage as it is fed prevents spoilage. 3. Many man-hours are saved in feeding by using a tractor loader and truck for loading the silage and hauling it to the silage bunks where it is fed once each day

GEORGE Q. BATEMAN AND CHARLES H. MICKELSEN

**T**HE use of a fence bunk silo has proved to be an efficient and economical way to store corn silage at the Dairy Research Farm.

Additions to the dairy herd made it necessary to increase the acreage of corn for silage and build additional storage space. During the early fall of 1958, a horizontal bunk fence silo (34 feet x 120 feet) was built at ground level and was filled with 496.7 tons of corn for silage. The sides of the silo were lined with sisalkraft paper and the top covered with a sheet of 8 mil polyethylene plastic. At the same harvest, 86.6 tons of silage were stored in the conventional cement stave silo. High quality silage from both silos was fed with little waste.

The use of upright temporary or tower silos requires more capital for construction and additional power, labor, and elevating equipment to put the corn in storage and take it out for feeding than is required when silage is stored in bunk silos.

GEORGE Q. BATEMAN is associate professor of dairy husbandry and in charge of the Dairy Experimental Farm. CHARLES H. MICKELSEN is a research associate and in charge of the physical facilities at the farm.

## Silage storage 1959-1960

The fence silo was built by using 7 feet 6 inch cedar posts set 2 feet 6 inches in the ground, twelve feet apart, with two light wooden stays placed at equal distance and driven approximately fifteen inches in the ground, at four foot spacing. When filling the silo, all harvest equipment was kept three feet away from the side to reduce the pressure, so that the sides would not be pushed out of line. The silo, when full, had a depth of 6 feet 6

inches at the highest point of the crown. This was one and one half feet higher than the top of the fence. The silage against the side was packed by a man walking next to the fence. With this method of filling, the top of the fence was pushed out approximately six inches from silage pressure but not enough to prevent the further use of the silo.

To obtain additional information on the use of the fence silo, the construction was simplified and strengthened for the storage of the

Silage storage—winter 1958-1959

	Fence bunk silo with plastic cover	Tower silo with plastic cover
Corn ensiled, green weight (tons)	496.7	86.6
Spoiled silage (tons)	4.4	2.0
" " (percent)	0.9	2.3
Silage fed (tons)	436.8	70.7
Total shrinkage (percent)	12.1	18.4
Difference in shrinkage in favor of fence bunk silo (percent)	6.3	00
Additional silage saved because of 6.3 percent less shrink (tons)	31.3	00
Value of additional silage @ \$7.00 per ton	218.68	
Cost of plastic cover 1 year	114.00	
Cost of plastic cover per year when used 2 years	57.00	
Savings indicated above cover cost:		
Use of cover 1 year only	104.68	
When cover is used 2 years	161.73	
		Cost of plastic cover for tower silo is a minor item and the cover can be used for a number of years.



# and economical way to store silage



Fig. 4. This silo was filled with 835 tons of chopped corn. The corn is covered and sealed with polyethylene plastic (8 mil). The plastic is held in place with discarded auto tires

1959-1960 corn crop. An attempt was made to procure heavy 8 feet 6 inch to 9 feet cedar posts so that they could be set three to four feet in the ground for greater strength. Cedar posts of this size were not available so 4 inch x 6 inch redwood posts were purchased at a cost of \$.30 per running foot, or \$2.40 and \$2.70 for eight and nine foot posts, respectively. At this price the cost of redwood will compare favorably with cedar and simplify construction. The earlier construction was removed and the new silo was built by placing the redwood posts at eight foot intervals and at a depth of four feet in the ground for the six center posts on each side where the crown of the finished silo is the highest and exerts the greatest pressure. All posts were set by tamping them in with gravel and sand, pit run.

Before filling, the one side of the silo was lined with sisalkraft paper which has proved satisfactory in the past, and the other side was lined with sisalkraft paper and two thicknesses of polyethylene plastic (4 and 8 mil) to determine the efficiency of plastic when placed in contact under pressure with the electric weld 11 gauge 2 inches x 4 inches x 4 feet wire fence.

In 1959 835 tons of corn were placed in the silo. The depth of the silage ranged from 0 to 9 feet 3 inches at the highest point of the finished crown. Even with this large tonnage, compared to a 6 foot 6 inch crown with 497 tons of the

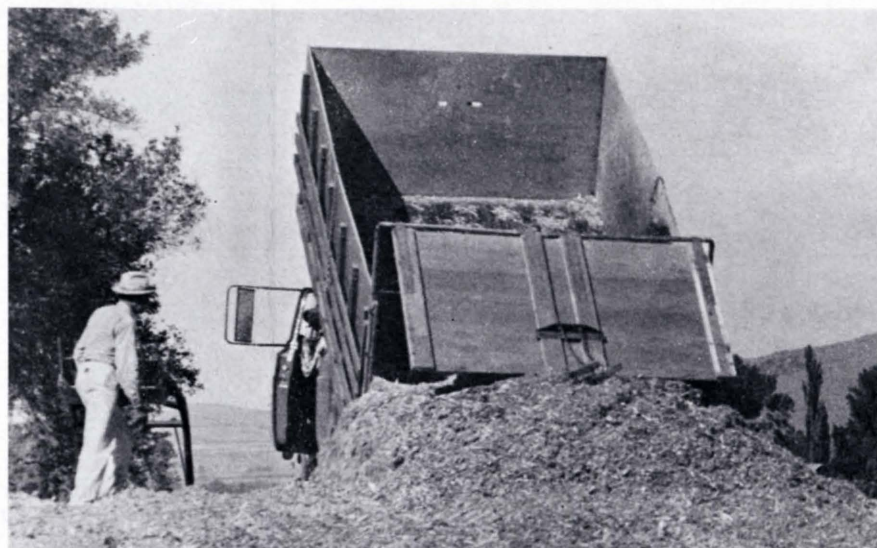


Fig. 5. The field chopped corn is dumped from the truck in the silo



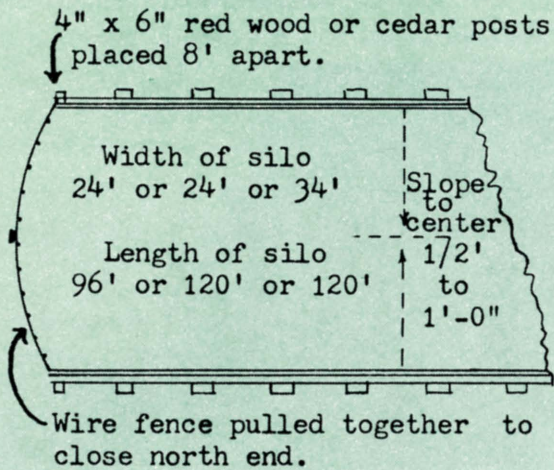
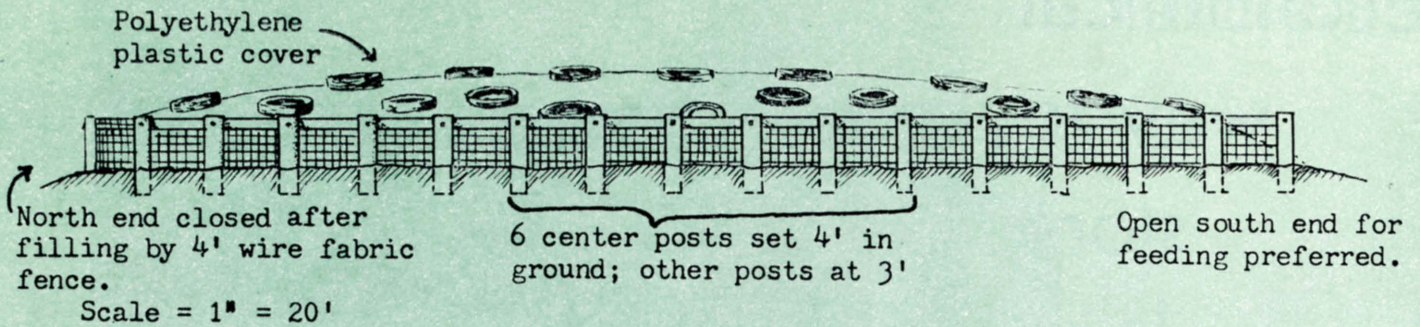
Fig. 6. It is spread and packed with a power tractor at a saving of labor and time

year before, the five foot fence remained erect with little or no dis-alignment.

The ground floor of the silo was sloped about  $\frac{1}{2}$  inch to 1 foot from each side to the center. Hard sur-

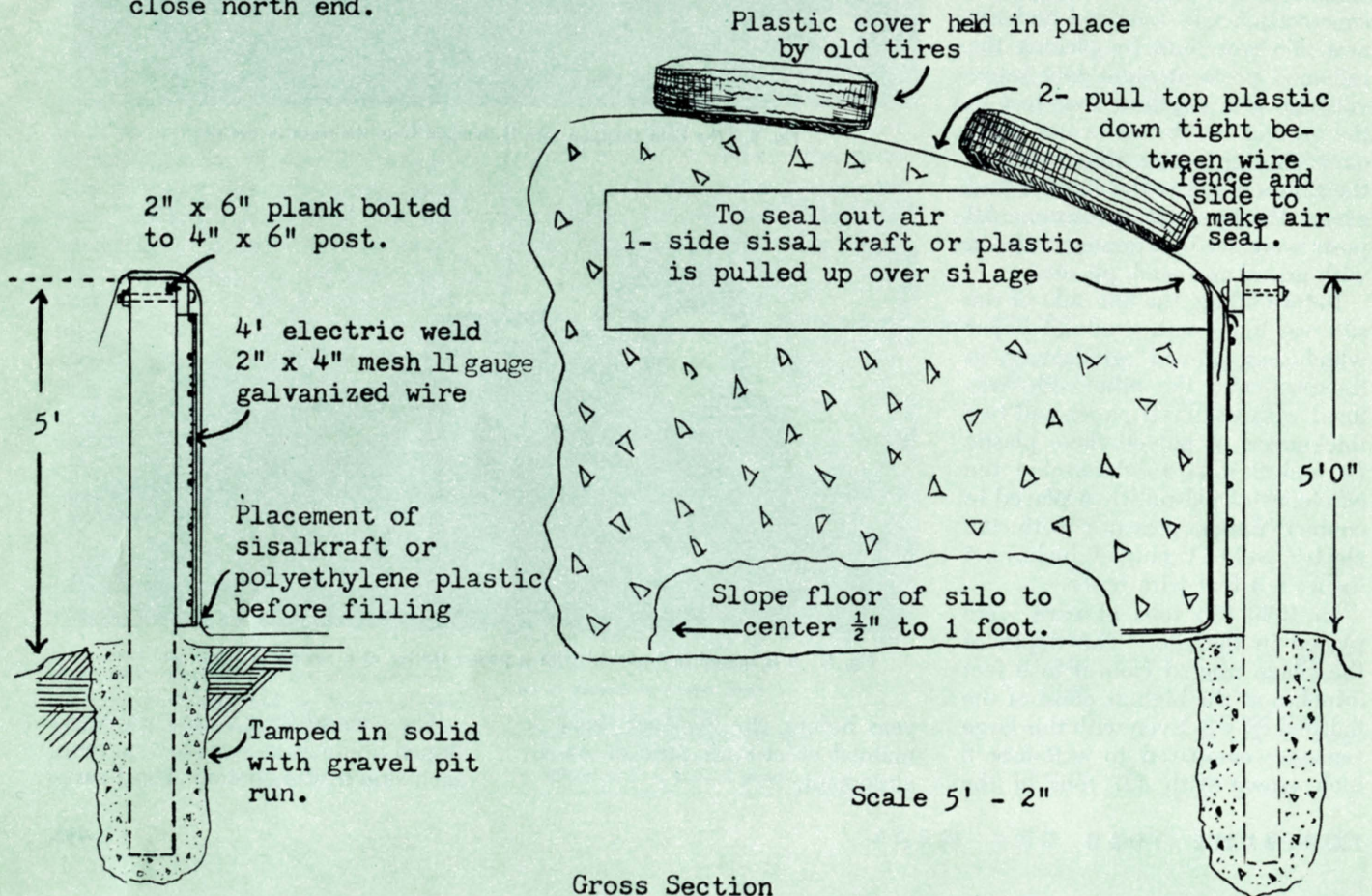


# DETAIL FOR CONSTRUCTION



## SIZE OF HERD AND CORN SILAGE REQUIREMENTS

				Amounts and storage required for 210 day winter feeding period		
Herd size		Silage		Size of silo		
Cows	Heifer	Tons	Acres	Width feet	Length feet	Height of crown
30	20	170	11	24	96	5'
60	40	340	23	24	120	6'
120	80	660	44	34	120	7'





The cost of materials for construction of fence silo and plastic were as follows, based on 835 tons green weight weighed into the silo at harvest time:

20 redwood posts 4" x 6" x 8' @ \$2.40	\$ 48.00
12 redwood posts 4" x 6" x 9' @ \$2.70	32.40
44-3/8" x 6" bolts and 90-1/2" washers	8.50
15 pieces No. 1 fir 2" x 6" x 16' @ \$120/1000	30.00
275 feet of electric weld 11 ga. 2" x 4" x 4' wire mesh	96.25
3 rolls of sisalkraft 666 sq. ft. or polyethylene plastic (8 mil)	36.75
Polyethylene cover (8 mil)	114.00
<b>Total material cost 1st year</b>	<b>366.00</b>
Material cost per ton for 1st year	.44
<b>New materials cost after 1st year:</b>	
Sisalkraft or plastic for sides	37.00
Plastic cover	114.00
<b>Total</b>	<b>151.00</b>
Per ton	.18
<b>Cost per year when plastic cover is used 2 years</b>	<b>93.75</b>
Cost per ton	.12

facing of the floor would have an advantage when the silage is removed with farm machinery during rainy weather.

At this date, approximately half of the silage has been fed out. An examination of the plastic on the sides indicates that both the 4 mil and 8 mil have prevented spoilage. However, the 4 mil tears more readily when the silage is removed. The 8 mil plastic is in good condition, and it may be possible to use it a second year. The 4 mil plastic is recommended for one year only. The 8 mil plastic cover that is in use for the second year is satisfactory in the prevention of spoilage. Sisalkraft paper is also a satisfactory lining for the sides of the silo. Advantage of the fence bunk silo over temporary wire fabric or tower silos:

1. It provides low cost efficient storage.
2. Driving through the silo for unloading eliminates tractor and blower machinery for elevating the silage. Possible clogging of blower and breakage are eliminated.
3. Time and labor are saved in unloading.
4. Loading the silage with a tractor loader saves both time and man labor in feeding.

5. There is little or no freezing of silage during cold weather.

6. One of the most important and significant advantages of the fence bunk silo is that when the plastic cover is pulled down securely between the wire and the plastic, or sisalkraft paper, along the sides to seal out the air, all drainage from the top of the silo runs through the wire mesh to the outside and does not run into the silo as is the case when the walls of the silo are made of planking or concrete. Under these conditions the water drains down the inside of the silo wall and increases spoilage which results in a poorer quality silage.

#### JACKRABBIT DAMAGE

(Continued from page 39)

11,400 rabbits were killed. This is an average of 3.5 jackrabbits per acre in the drive area. This doesn't sound serious until the quantity of forage consumed by the jackrabbits is calculated. When this is done (using a conversion factor of 20:1), it is discovered that the 11,400 jackrabbits would consume enough feed to supply the needs of 570 ewes or 114 cows. It looks like

jackrabbits are eating us out of sheep and cows!

#### *Jackrabbits more destructive than livestock*

Jackrabbits are more destructive to native plants than livestock are because they graze closer than do livestock (fig. 4). Sheep usually take little more than the current year's growth of a shrub, which leaves a stem still capable of producing new twig growth. Jackrabbits take the two- or three-year old tissue and waste the current year's growth. This means that the possibility of renewed growth from lateral buds is practically destroyed. As a result, after a few years of repeated use the shrub is killed.

On grasses the effect of jackrabbit grazing is equally disastrous because green growth is eaten almost as rapidly as it is produced. Livestock usually leave a stubble on grass plants, but rabbits clip the grass stems at the soil line or even below the soil line when food supplies are low. As a result, the vigor of the plant is slowly reduced until the grass plant, too, is dead.

Unlike livestock, which make periodic use of most ranges, jackrabbits remain continuously on a given range. Although they do shift from heavy use of shrubs during fall and winter to concentrate on grasses in spring and summer, they probably remain in a single land section most of their lives. The only rest which native range receives from use by jackrabbits comes when numbers become low as a result of predation or disease. Then for a year or two intensity of use decreases and range plants have an opportunity to recover.

Jackrabbits and other smaller mammals are of tremendous importance in the management of native rangeland. Their importance has not been appreciated in the past but must receive attention and serious study in the future. At Utah State University at Logan, studies are currently in progress to determine the extent to which jackrabbits alone influence range condition and trend.





## RETAIL MARGINS on perishable items

**Stores concerned about price margin for department and not for individual commodities. Consequently the margin on a particular item does not necessarily reflect the cost of handling that item**

ELLIS W. LAMBORN AND ALBERT G. MADSEN

**T**he retail store, because of its location in the marketing channel, is in a position to influence the purchases of consumers. This influence is exerted in many different ways. Merchandising may be described as the use of such factors as price, quality, display, and advertising to encourage customers to patronize individual stores or to buy particular products within a store. The retailer may be able to influence the actions of consumers, but consumers are the ultimate and final judges of which products will move into consumption.

To determine the markup taken by the different types of retail food stores on perishable produce, data were obtained from 156 stores in Salt Lake, Weber, and Davis Counties during the seven week period, April 13 through June 1, 1959. An effort was made to obtain about equal numbers of stores in each of three categories. Fifty-eight of the stores were independently owned and operated, 58 were affiliated

with a buying group, and 40 were owned and operated by various chain organizations. A chain store was defined as a store owned and operated by an individual or organization operating 3 or more similar stores. After the sample was stratified as to store ownership the stores within each group were picked to get a typical representation.

The survey method was used to obtain the data. The produce manager or owner of each food retail store was interviewed personally. They were asked to explain their reasons for the difference in markups among commodities and how prices in general were established. For seven commodities, lettuce, tomatoes, apples, strawberries, oranges, grapefruit, and bananas purchase prices, sale prices, and the amount of waste for the week before the survey was taken were obtained. From these data it was possible to compute the markup for each commodity for each store. In conformance with common practice the sale price, rather than purchase price was used to arrive at the markup. The volume of each commodity purchased and sold was also obtained.

### *Factors affecting markup*

There was some difference among the three types of stores as to the reasons for the difference in the markup among commodities. Independent and affiliated retail food stores listed "meeting competition" most frequently as justification for differences in markup. Chain store managers gave as their most important reasons some variation of the "demand and supply" theme. Indications were that the chain stores were the price leaders and that after they had set their prices the other stores tended to fall in line. However, the chain store managers listed as their second most important reason "meeting competition." So the chain stores are not without restrictions when the problem of setting prices is considered.

### *Purchase price*

Chain stores showed a distinct advantage over independent and affiliated stores in the purchase of lettuce (table 1). The purchase price for chain stores was slightly lower for the remainder of the commodities included except oranges.

(Continued on page 62)

DR. ELLIS W. LAMBORN is associate professor of agricultural economics. MR. MADSEN is a graduate student who helped with the project.





# FRUITS AND VEGETABLES OFFERED BY RETAIL STORES

**Customer finds wide range in variety, price, and quality. She must consider all these in determining best buy**

**LEORA S. GALLOWAY AND ETHELWYN B. WILCOX**

**T**HE consumer, when she shops for groceries, is interested in a store that has a large variety of fresh and processed fruits and vegetables throughout the year as well as in the price of the products and the type of service offered by the grocery store. The homemaker prepares and serves an average of 90 meals each month and 1,095 meals each year. No wonder she is interested in a variety of products when she shops for food. Variety in both type and kind of food served usually means better balanced meals nutritionally and it keeps the family more satisfied and happy.

Twenty-four retail grocery stores were selected from a group of 151 in Salt Lake County to determine the availability of fresh, frozen, canned, and dried fruits and vegetables. These stores were surveyed

for fresh products each month from April through September and in November, January, and March. Since there was little variation in the availability of processed products from one month to another, frozen products were surveyed in May, August, and January; canned products in April, July, and November; and dried products in June, September, and March. Essential information as to kind of product, type of package, and price per pound of the fresh and processed fruits and vegetables was recorded on tabulated sheets made for that purpose.

Of the 24 stores surveyed, 19 were in urban areas and only 5 were in rural areas.

Several fresh fruits and vegetables, namely, oranges, lemons, bananas, grapefruit, carrots, cabbage, celery, and tomatoes were available in all the stores. Pink grapefruit was offered more times than white. Package grapefruit and oranges were offered in only a few of the stores. Package apples were available in September, November, January, and March in four stores. Bulk apples were available much more frequently. Lettuce and dry

onions were found in 22 stores; also potatoes, except for July when only four stores had potatoes.

The number of stores in which other common fruits and vegetables were available is given in table 1. Some fruits and vegetables were available throughout all the months surveyed, but not in all the stores surveyed.

The price of the fresh fruits and vegetables varied from month to month and from store to store, but in almost all cases the products were the cheapest when in season. Prices were more stable from month to month on such fruits as bananas, grapefruit, lemons, and oranges, and vegetables such as beets, lettuce, mature potatoes, and carrots. The largest majority of stores had the price listed on their fresh fruits and vegetables and practically all the stores had the price listed on their frozen fruits and vegetables, frozen juices, and dried fruits and vegetables.

The number of stores in which processed products were available represents an average for the three months each was surveyed.

Of the canned fruits, applesauce, apricots, blueberries, red tart cher-

**MRS. LEORA S. GALLOWAY** was research associate in foods and nutrition. **Dr. Wilcox** is professor of foods and nutrition and in charge of the research in that area. The study reported here is part of a Western Regional Research project and was financed in part under the Research and Marketing Act of 1946.



ries, fruit cocktail, grapefruit sections, peaches, pears, and pineapple were available in all but one or two of the stores. Raspberries, black cherries, strawberries, Royal Ann cherries, purple plums, white figs, and boysenberries were available in 8 to 18 stores in ascending order.

Canned juices, including apple, grape, grapefruit, mixed vegetable, orange, orange and grapefruit, and tomato juice were carried in 22 or more of the 24 stores. From store to store and month by month, canned apricots varied most in price among canned fruits, while asparagus was the most variable of the vegetables.

A list of some of the frozen fruits and vegetables surveyed, the availability as measured by number of stores, and also the range in price per pound are given in table 2.

Nine dried fruits were included in the survey and varied in availability from 3 stores for sliced pears to 24 for seedless raisins and prunes. The availability by number of stores of the others listed was as follows: sliced apples 9, applesauce 6, apricot halves 12, dark figs and peach halves 10, and seeded raisins 17. The price per pound for sliced apples varied from 54 to 98 cents, for apricot halves 80 to 129 cents, and for peach halves 47 to 81 cents.

Eight dried vegetables were listed in the survey. Six of these were varieties of dried beans and varied in availability from 19 stores for pink beans to 24 for lima beans. Split peas were available in 23 stores and instant potatoes in 20. The price as listed for lima beans ranged from 13 to 27 cents, for white beans 13 to 21 cents, and for split peas 17 to 28 cents per pound in the different stores.

Of the canned and frozen fruits which could be directly compared, pineapple and red, tart cherries were similar in price for either form of processing while frozen peaches were considerably more expensive than canned peaches (31-53 cents vs 16-28 cents). Frozen grapefruit or orange juice cost three to four times more than the canned prod-

Table 1. Average number of stores in which fresh fruits and vegetables were available in Salt Lake grocery stores

Product	Number of stores					
	May	July	Sept.	Nov.	Jan.	March
<b>FRESH FRUITS</b>						
Apples, bulk	21	16	23	23	23	23
Pears	4	2	18	16	13	11
Strawberries	21	8	4	—	—	1
Cantaloupe	8	24	22	—	—	1
Watermelon	10	21	16	—	—	—
<b>FRESH VEGETABLES</b>						
Green beans	4	14	13	5	—	—
Beets	6	9	8	6	6	8
Broccoli	7	—	2	12	16	12
Cauliflower	16	13	21	18	19	20
Corn on cob	20	21	20	10	—	1
Endive	10	7	8	12	11	13
Peas	11	4	—	—	—	4
Romaine	10	12	8	8	11	10
Spinach	16	—	—	21	20	20
Squash	24	19	19	20	15	11

Table 2. Number of stores in which frozen fruits and vegetables were available and price range in Salt Lake grocery stores

Product	Number stores	Price per lb.	Product	Number stores	Price per lb.
<b>FRUITS</b>			<b>VEGETABLES</b>		
cents			cents		
Sliced peaches	10	31-53	Green peas	24	19-35
Pineapple chunks	10	28-34	Asparagus spears	22	56-91
Raspberries	20	32-69	Green beans	22	32-44
Sliced strawberries	24	24-53	Broccoli spears	22	30-60
<b>JUICES</b>			Corn, whole kernel	22	21-40
Grapefruit juice	12	32-56	Potatoes, French fr.	22	32-41
Orange juice	24	37-72	Spinach	21	25-37
			Squash	14	20-34

uct. Frozen vegetables were also more expensive than the canned product. Ranges in cost varied from 11 to 31 cents vs 19 to 35 cents for canned and frozen peas, respectively, to 30 to 62 vs 56 to 91 cents for canned and frozen asparagus. The price spread in some dried fruits was wide, amounting to 40 cents or more per pound in sliced apples and apricots. The

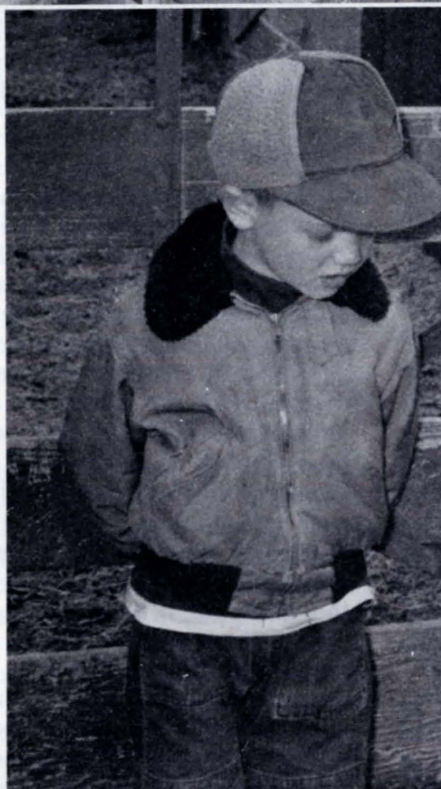
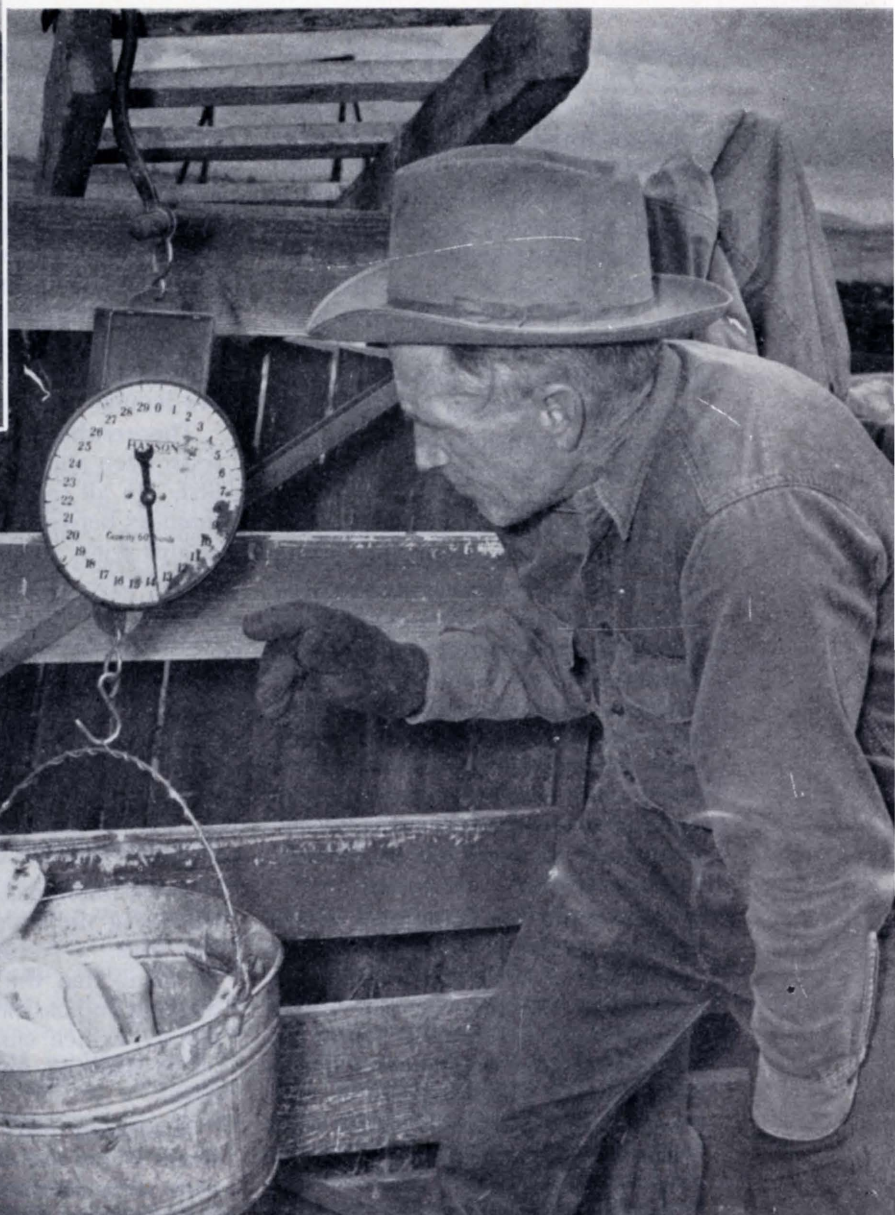
dried vegetables showed a narrow price spread.

These findings indicate that customers have quite a wide range in price in processed foods from which to choose. Quality also varies within these price ranges. The best buy can only be determined after the housewife considers quality, cost, and use of each product in her menus.

#### INDEX TO FARM AND HOME SCIENCE

A subject and author index to volumes 11 through 20, 1950-1959, is just off the press and is available to libraries and individuals. An index to volumes 1 through 10, 1940 to 1949 is still in print and will be sent on request.





The weights of all lambs were taken just before docking and at one and two week intervals following docking

D. H. MATTHEWS  
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## LAMB DOCKING METHODS

**Best method is one most adaptable to lambing management practices**

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**S**OUND practice must be followed in lamb docking operations to prevent losses and to fit the operation to the ranch management program. Many methods of castration and docking have been used by sheepmen with some conflicting reports of success or severe losses.

Sheepmen generally have been undecided as to which method was best.

A two-year study of the effectiveness of various methods of castrating and docking lambs completed at the Utah State University Livestock and Range Field Station at



Cedar City, Utah, indicated there were no significant differences among the methods in lamb losses and in weight gains following the docking operation. The *best* method of docking is the one which is most adaptable to the lambing management practices of the operator.

#### *Docking methods studied*

The study was initiated to determine the effect of various methods of castrating and docking on the weight gains of lambs following the initial shock of the operation and to determine the difference in lamb deaths either directly or indirectly caused by these methods. The methods of docking used were: knife, hot spade iron, emasculator, and elastrator. Castration was done with the elastrator and knife with manual removal of the testicles. Both twin and single lambs and male and female lambs were docked using all combinations of the various methods.

The study was completed in two years. In the first year, 151 lambs in groups of twins and singles were docked. Weights of the lambs were taken immediately before the operation and again two weeks following. Weight gains at two weeks and lamb losses within each group were determined. In the second year, 235 lambs were docked using the same method combinations. In order to get a closer evaluation of the effect of the operation shock on the weight gains of the lambs, the groups were weighed at one and two week intervals following the operation. All lambs were docked between eight and sixteen days of age. The average age was ten days.

#### *Results of tests*

Average gains for the lambs in all of the treatment combination groups were similar. The only lamb deaths caused by the docking operation itself in the two years of the test were caused in the group where the tails were removed with

a knife and the testicles were removed with the elastrator. Two male lambs out of a group of six in this treatment group died from excessive hemorrhage immediately following the operation. This combination of methods was discontinued as it was observed that lambs castrated and docked in this manner struggle because of the stricture of the elastrator which causes excessive bleeding from the tail wound.

The results of the second year tests were similar to those of the first. In all cases weight gain differences between lambs within the groups were greater than the gain differences between treatment groups in both the one and two week intervals after docking. Lamb losses were again small with no losses attributed to docking operations. Comparable losses occurred within treatment groups from all other causes of death.

#### *Recommended practices*

As no differences in docking and castrating methods were found in the tests, a recommendation can be made that the best method of docking and castrating lambs is the method which can best be adapted to lambing management practices.

Sheepmen who are lambing in sheds where the ewes are confined with their lambs for a period of time find that the elastrator is best adapted to their use. It is possible to dock and castrate lambs on the day they are born with the elastrator. This allows the operator to perform the operation while the ewes and lambs are in the segregation shed with little additional labor. When this docking operation is performed during the segregation period, the lamb recovers from the initial shock while with his mother and is not again removed from her side after leaving the lambing shed; thus reducing the number of dogged lambs. The elastrator method of docking and castrating lambs at from eight to fifteen hours of age has been used at the Cedar City Station since 1952 with good

success. As shown in a mortality study, death losses due to the docking operation have averaged .03 percent of all lambs born.

An advantage of the knife method of testicle removal is that there is less chance of failure to perform the operation and leave a ram or stag lamb in the herd. It is of particular importance in preventing losses to complete the operation rapidly and return the lambs to their mothers.

Range lambing operators usually prefer the knife, the emasculator, or one of the hot iron methods of docking. These methods are faster.

#### *Precautions*

Cleanliness is of particular importance in the docking operation. Equipment should be cleaned thoroughly before starting, and a good disinfectant should be used on equipment such as the emasculator which actually comes into contact with the wound on each lamb's tail. This tool may be kept in a bucket of disinfectant solution into which it is replaced after each operation.

Manual removal of the testicles of extremely young lambs may tear the immature internal abdominal tissues excessively, resulting in internal bleeding and death; however, lambs recover more quickly with less actual shock when the docking operation is performed by the time they are two weeks of age. Docking early allows the lamb to recover from the operation during the early suckling stage when it is believed there may be some natural immunities to infection from the mother's milk.

The elastrator method of docking should never be used on lambs more than ten days of age, and it is better if the lambs are under one week of age when docked. When larger lambs are docked with this method the rubber elastrator ring frequently fails to shut off the entire blood supply to the tail thus the tail becomes engorged with blood and eventually infection or tetanus may result with numerous mortalities. Only new live rubber



rings should be used as old rings may result in losses due to failure of the ring to stop the blood supply.

The recommended method of application of the elastrator ring to the tail and the testicles is to place the lamb between the legs with the back up and with the head extended out behind the operator. The operator can then place the ring on the testicles and the tail while the lamb is in an upright position. The testicles should always be examined after application of the ring to determine if both testicles have been secured and that the urethra of the lamb has not been pinched and held by the ring. When the elastrator is applied while the lamb is held with his back down, as in the knife method of removal, there is considerable danger of closing off the urethra and thus stopping the flow of urine. Lambs which have a closed urethra will die within one or two days as a result of uremic poisoning.

Rules to follow in selecting a docking method and preventing lamb death losses are: 1. Dock lambs early especially when using elastrator rings. 2. Use sanitary procedures and dock in clean corals or surroundings. 3. Follow recommended methods of application. 4. Feed animals well before and immediately after the operation.

## TUMOROUS HEAD

(Continued from page 41)

and the possible relation between the substance and the gene (*tu-1*) which controls its production in the female fly.

### *Effect of other genes on tumorous head*

At the same time the laboratory experiments were under way, samples of wild populations of flies were collected and mated with tumorous head flies. Some were found to carry genes that will, in combination with *tu-3*, produce a maternal effect similar to or in some cases greater than that produced

by *tu-1*. Three "wild" laboratory stocks, Stephenville, Crimea, and Oregon R. (named from the location where they were collected) were found by appropriate crosses to carry such genes. When Stephenville females were mated with tumorous head males about 50 percent of the progeny were abnormal. The Stephenville stock is postulated to carry an allele (i.e. an alternative gene) of *tu-1*, symbolized *tu-1<sup>s</sup>*, which has a greater influence on the maternal effect than *tu-1*.

To study the behavior and influence of alleles such as *tu-1* and *tu-1<sup>s</sup>* in the laboratory, population cages (fig. 3) were constructed to hold the flies. Fresh food medium was supplied daily by removing corks at the bottom of the box and replacing the oldest food jars with those containing fresh medium. Populations were started from single pairs of flies which were introduced into each cage at the beginning of each experiment. The flies multiplied without restriction and within about 2 months a population of some 5000 flies was present in each cage. At this level the population became stabilized and did not increase further. It was possible to sample the population in each cage at intervals and to determine the relative proportion of flies which expressed the abnormality.

In one series of recent experiments, researchers compared the behavior of the *tu-1* and *tu-1<sup>s</sup>* alleles by preparing population cages with different combinations of alleles. A single pair of tumorous head flies was placed in cage 1. In cage 2 a Stephenville female was mated with a tumorous head male. The female in cage 3 carried *tu-1<sup>s</sup>* in homozygous condition and the male carried one *tu-1<sup>s</sup>* gene. The *tu-3* gene was present in both third chromosomes in both parents.

At monthly intervals samples of 100 flies were extracted from each cage, examined for tumorous head expression and returned to the cage. The results are summarized in fig. 4. In cage 1 the expression decreased from 89 percent at the

end of the first month to less than 10 percent at the end of the sixth month. At that time the expression apparently became stabilized at a level ranging between 5 and 10 percent. The level of expression in cage 2 has remained fairly constant at a level ranging between 21 and 34 percent for 8 months. Cage 3 has also maintained a fairly constant expression with a range between 63 and 76 percent during the 8 month period.

One explanation for the drop in expression of the tumorous head flies may be suggested from the history of the stock. The tumorous head flies placed in cage 1 had come from a highly selected stock in which modifiers favoring the expression of the abnormality had been accumulated over a period of years. Apparently the modifiers were dissipated when artificial selection was discontinued. An equilibrium was established at a lower level after six months of random mating in the cage. In cage 2 the first generation females carried both (*tu-1<sup>s</sup>/tu-1*) alleles, and they also carried one *tu-3* gene (*tu-3+*). This was apparently a better combination than the one in cage 1 for the expression of the trait. The flies in cage 3 were synthesized for the experiment and did not have the modifiers which had been accumulated in the tumorous head stock. This was the best combination for the expression of the trait in the population. Since the trait is a serious abnormality, it is the worst combination as far as the individual flies are concerned.

Studies of this kind should provide an explanation for the behavior of alleles in populations. A possible explanation of the origin of the tumorous head trait is that the population of flies in Mexico from which the collection was made already carried the gene now symbolized *tu-1* (like several wild stocks now known) and that the *tu-3* gene necessary for the expression of the visible abnormality occurred as a spontaneous mutation while the stock was maintained at the University of Texas.



## MARKET MILK

(Continued from page 37)

ket milk and consumers purchased 11 million pounds.

### Plant receipts increase faster than fluid sales

The preceding analysis shows how well we are able to meet our fluid milk and cream needs, assuming that no market milk is shipped

into or out of the state. In actual practice grade A plants in Utah receive some milk from out-of-state producers (about 4 percent) and sell some of their fluid products out-of-state (about 10 percent). In addition, about 4 percent of the market milk produced in Utah is shipped direct by farmers to Nevada plants.

Receipts of market milk by Utah plants increased from about 195

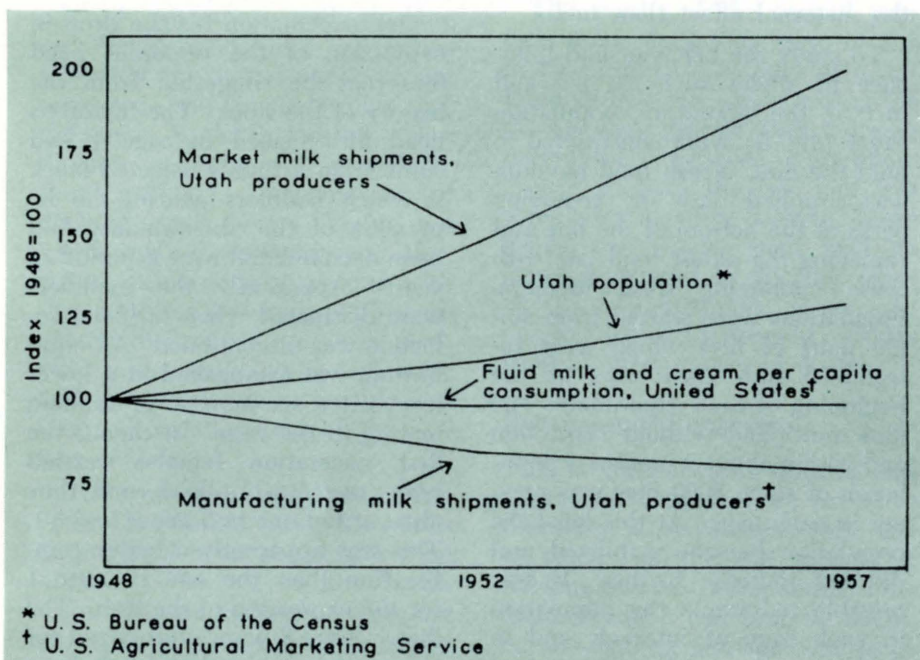
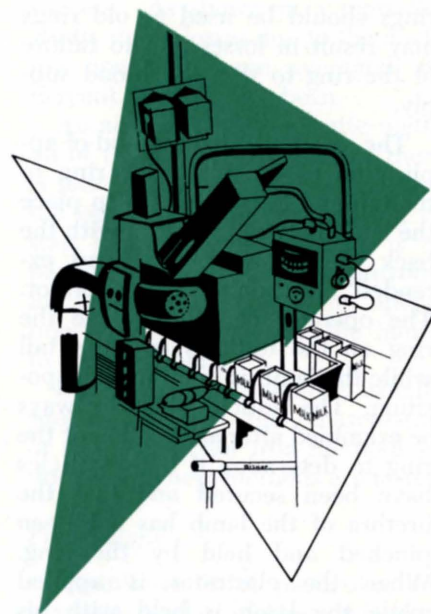


Fig. 1. Trends in population and shipments of milk in Utah, and fluid milk and cream per capita consumption in the United States, 1948, 1952, 1957

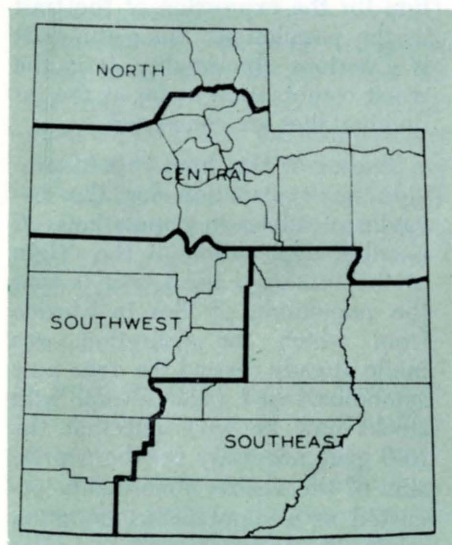


Fig. 2. Market milk production areas

million pounds in 1948 to 401 million pounds in 1957—an increase of about 8 percent per year. This closely resembles the increase in shipments by Utah producers mentioned earlier since about the same amount of milk is received by Utah plants from out-of-state producers

as is shipped direct by Utah producers to out-of-state plants.

Plant sales of fluid milk and cream increased from about 165 million pounds in 1948 to 255 million pounds in 1957—an increase of about 5 percent per year. Since receipts of market milk increased more rapidly than sales the percent of fluid use decreased—from 85 in 1948 to 64 in 1957. Plant receipts have continued to increase faster than fluid sales since 1957. The percent of receipts used as fluid is estimated at about 58 in 1958 and 55 in 1959.

The percent of plant receipts used for fluid purposes in 1948 indicates a favorable supply-consumption balance. Not much more than 85 percent of receipts can be used for fluid purposes if a market is self-sufficient and does not rely on supplemental shipments of milk from other sources during low-

Table 2. Shipments of market milk and plant sales of fluid milk and cream, by area, Utah, 1957

Area	Shipments of market milk to plants		Plant sales of fluid milk and cream	
	million lbs.	percent	million lbs.	percent
North	81	20	15	7
Central	249	62	194	84
Southwest	63	16	12	5
Southeast	8	2	9	4
Total	401	100	230	100



Table 3. Use of market milk, Utah plants, 1948, 1952, and 1957

Year	Plant receipts*	Use*		Percent used as fluid milk and cream
		Fluid milk and cream	Non-fluid uses	
	million pounds	million pounds	million pounds	
1948	195	165†	30‡	85
1952	287	205§	82	71
1957	401	255§	146	64

\*Does not include milk handled by I.D.S. welfare dairies.

†Based on estimated consumption of plant sales of fluid milk and cream of 243 pounds per capita, a Utah population of 653,000, and estimated out-of-state fluid milk and cream sales by plants of 10 million pounds.

‡Based on estimated consumption of plant sales of fluid milk and cream of 245 pounds per capita, a Utah population of 730,000, and out-of-state fluid milk and cream sales by plants of 25,303,000 pounds.

§Based on actual consumption of plant sales of fluid milk and cream of 254 pounds per capita, a Utah population of 840,000, and out-of-state fluid milk and cream sales by plants of 41,837,000 pounds.

||Plant receipts less fluid milk and cream sales.

production — high - consumption months. In order always to have an adequate supply of milk a reserve during each month of at least 10 percent above normal fluid use is necessary as a cushion against variations that might occur in daily consumption and receipts.

Utah plants received a considerable surplus of market milk above requirements for fluid use in 1957. The amount that was sold for fluid purposes in 1957, the reserve necessary to insure an adequate supply, and the amount that was surplus or unessential to the fluid market are shown in figure 3. Plant receipts are shown by the total height of the bars. Variation by month in height of the shaded areas and total height of the bars depict seasonal variation in fluid milk and cream sales and plant receipts.

The milk and cream used as fluid as shown in the lower part of the bars amounted to 64 percent of plant receipts during the entire year. The milk which was necessary as a reserve amounted to 18 percent of fluid sales or 11 percent of plant receipts during the year. (The reserve was more than 10 percent of fluid milk and cream sales for the year because in order to have a 10 percent reserve in November when plant receipts were lowest and sales of fluid milk and cream were near their highest for the year, a larger reserve had to be

carried during the other months of the year, such as June when plant receipts were highest and fluid sales were lowest.) Thus for 1957 fluid milk and cream sales plus an adequate reserve amounted to 75 percent of plant receipts. The remaining 25 percent was surplus market milk and was not needed to provide the market with an adequate supply of fluid milk and cream. Although this milk is surplus in the sense it is not needed for fluid purposes, there is an ade-

quate demand in this area to handle any likely amounts of such milk for manufacturing purposes.

#### NEW PUBLICATIONS

Bul. 419. Insect pollinators of carrots in Utah, by G. E. Bohart and W. P. Nye. In cooperation with the Entomology Research Division, U. S. Department of Agriculture. 16 p.

This bulletin is of special interest to entomologists and seed growers. It discusses the pollinating activities of 334 species of insects representing 71 families.

Cir. 142. Fertilizer guide for Utah, by R. F. Nielson, G. A. Van Epps, and P. D. Christensen. Department of Agronomy. 12 p.

General information on the use of fertilizers is discussed under the following heads: steps to high yields; nutrients needed by plants; make use of manure; what's in the bag; which fertilizer to use; it makes little difference how you apply fertilizers; fertilizer practices for various crops.

Utah Res. Ser. 8. Mineral resources of the five county area, southwestern Utah, by D. R. Olsen and J. Stewart Williams.

This publication reports a survey of the economic mineral resources of Beaver, Iron, Washington, Kane, and Garfield Counties, Utah.

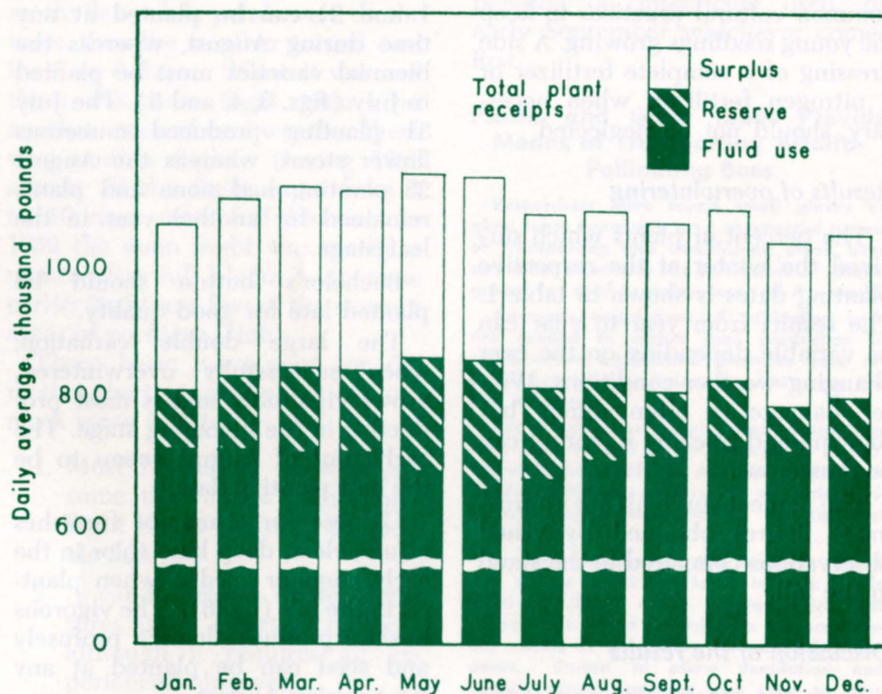


Fig. 3. Variation in monthly plant receipts and use of market milk, Utah, 1957



## OVERWINTERING FLOWERS

(Continued from page 36)

The planting is done preferably in rows and when east-west direction can be chosen, the seed is placed on the north sloping area close to the irrigation furrow. Such placement gives the young seedlings better protection against the winter sun.

Primary concern must be given to correct watering. This requires that the soil surface is constantly moist. Any drying out during the germination period is hazardous. The soil should be well saturated with moisture before planting and after planting. The water should flow slowly through irrigation furrows or a fine sprinkler should be running as often as surface drying is observed.

The constant evaporation of moisture on the soil surface is important to cool the soil temperature, which during July and August in dry soil can be far above normal.

It is not at all difficult to obtain high germination in the peak of the hot season if the above recommendations are observed. After germination care must be given to common cultural practices to keep the young seedlings growing. A side dressing of a complete fertilizer or a nitrogen fertilizer, when necessary, should not be neglected.

### Results of overwintering

The percent of plants which survived the winter at the respective planting dates is shown in table 1. The results from year to year can be variable depending on the ever changing weather conditions. Winter damage is often minor but thawing and freezing in spring can be dangerous.

The percent survivals are approximate figures obtained by visual observations compared to the stand in the fall.

### Discussion of the results

From the results obtained at the different planting dates, the flow-

ers can be put in two distinct groups. One group of flowers seems to be indifferent to planting time — any time from the beginning to the end of August is successful, whereas the other group has maximum returns only when planted at a definite period.

Cheiranthus, bachelor's button, Chinese forget-me-not, gloriosa daisy, sweet-william, and larkspur belong to the first group. The differences in this group are more in the size of the plants and in the quantity of flowers produced. The earlier plantings are superior in quantity of flowers. When planted in the middle of August these flowers show superiority in quality of bloom. Quality is measured by uniformity and uprightness in growth with profuse flowering. The first plantings often showed signs of over maturing causing uneven, long, and curved stems.

A definite planting time is more important for flowers in the second group.

Winter hardiness in Chinese asters is unpredictable and fall planting is not promising in our area. A few plants survived a middle of August planting in one year.

Annual Canterbury bells (figs. 1 and 2) can be planted at any time during August, whereas the biennial varieties must be planted in July (figs. 3, 4, and 5). The July 31 planting produced numerous flower stems, whereas the August 23 planting had none and plants remained for another year in the leaf stage.

Bachelor's button should be planted late for good quality.

The large double carnation, when successfully overwintered, grows vigorously and is most productive in the blooming stage. The early part of August seems to be the best planting date.

Chinese forget-me-not furnishes a rare, clear, deep blue color in the early summer garden when planted in the fall (fig. 6). The vigorous bushes produce flowers profusely and seed can be planted at any time during August.

Gloriosa daisy, the large tetra-

ploid rudbeckia, overwinters when planted at any time during August but is superior in quantitative growth when planted in the first part of August. Rudbeckia Starlight and My Joy can also be planted in the fall. Their winter hardiness is below gloriosa daisy.

Feverfew is best planted in the first part of August. This plant produces an attractive flowering bush early in the season.

The annual delphinium was overwintered satisfactorily and the perennial has been recommended earlier in this article.

Snapdragon plantings made in the first part of August overwintered satisfactorily and produced an excellent crop. The middle of August planting, especially when the fall is warm, is superior for producing quality plants (figs. 7 and 8).

Annual scabiosas are excellent, long lasting cut flowers. Overwintered plants of early August plantings are more productive and superior to any spring planting.

Lupine Russel, a beautiful hybrid, can be highly recommended for fall planting. Young seedlings of early plantings may freeze in severe winters. In such cases late plantings are more successful as part of the seed does not germinate until early spring which saves the crop (figs. 9 and 10).

Candytuft is best planted at the end of August or early in September. Earlier plantings are too mature in the fall and winter kill or produce crooked stems. Overwintered candytuft produces an excellent crop early in the spring (figs. 11 and 12).

The easy to grow, hardy biennials, such as scented wallflower, Siberian wallflower, sweet-william, hollyhock, pansy, and larkspur should be planted directly outdoors in the fall. They furnish excellent material for decorating the home or are decorative for landscaping. The intense orange or yellow color of Siberian wallflower can hardly be surpassed. Care must be taken to prevent broadcasting of the seed of larkspur and hollyhock.



Along with the flowers discussed in this publication others may be added, especially where climatic conditions are more favorable than in the Farmington area where the above experiment was conducted. The success of planting and overwintering depends also on personal experience and the knowledge of local climatic conditions. For this reason unsatisfactory results of the first trials should not be discouraging to the beginner.

### CODLING MOTH

(Continued from page 43)

spray is needed for best results in Utah.

Sevin:

1. Is among the safer insecticides for man to handle.
2. Has injured plant tissue on occasions, especially just after blossom time.
3. Makes mite control more difficult.
4. Best results in Utah have been achieved with 1 1/2 pounds of insecticide per 100 gallons of spray.

Several other materials have shown interesting results in codling moth control, although the kill has been less complete than with either Guthion or Sevin. Diazinon and Trithion have recently been used as so-called all purpose sprays. They have some merit and certainly make insect control less complicated. Neither is as effective against codling moths as Guthion or Sevin, but they do a fair job of control. We have considerable evidence that Diazinon used at about two week intervals may give results almost as good as Guthion or Sevin at three week intervals. Another material, Ryania, has been widely used in Nova Scotia. Ryania allows most beneficial insects to survive and thus aid in control of all orchard pests. Usually mite and aphid control is accomplished with little effort where Ryania is used. Unfortunately codling moth control with Ryania in Utah falls short of

commercial standards. This is especially apparent by an unusually large number of "stings" or surface injury to the fruit.

### How to time sprays

The best control of the codling moth is obtained only when sprays are applied at the proper times. The first application of the season is most difficult to time correctly, and it is also the key to adequate seasonal control.

The codling moth spends the winter as a worm or caterpillar in a hidden crack or crevice. Just before the tree buds begin to open the caterpillar pupates. It remains as a pupa for 15 days or longer until the temperature is warm enough for the adult to emerge. After 15 to 20 days as a pupa, whenever temperatures are above 65° during the late afternoon, the moths begin to fly. After the first warm afternoon only a few moths will emerge in the evening, while after the second and third warm afternoons there will be heavy flights. This dependence on temperature may mean that moths can begin to fly any time from late blossom until a month after blossom. During 1957 in northern Utah the first moths flew while petals were on the trees, then the weather turned cool for 5 or 6 days. When it warmed there was more flight, then after another week of cool weather there was another flight. During 1958 almost all the flight came from 5 to 10 days after full bloom. In 1959 the main flight was nearly a month after full bloom, with some earlier flight in a few of the warmer areas of northern Utah.

Three basic ways exist for detecting the time of the first codling moth spray in Utah.

1. Most frequently growers assume that moths begin their flight about the time the petals fall.
2. A careful check on temperatures is an effective method, although it requires an experienced observer.
3. For many years bait pan traps

were used, but have been gradually abandoned due to a feeling of false security when using DDT.

Of the three methods the latter is certainly the most reliable. We recommend bait pan traps for use in commercial orchards where high quality fruit is being produced and one of the other two methods for home orchardists. Several county agricultural agents publish the flight dates in their local papers.

Following the spring codling moth flight during which the eggs are laid there is a waiting period of about 10 days before sprays should be applied. The reason for this is that the eggs require from 10 days to two weeks to hatch during the spring. By waiting about 10 days the spray will be at full strength when the eggs hatch. Sprays directed against the adult flight have some merit, but are usually less effective in over-all control than sprays against the hatching worms.

Following the first spray, our best results in Utah have usually been obtained from a regular series of sprays at about 18 to 21 day intervals. Use these up to three to five weeks before harvest depending on insecticide used, or early September whichever comes first.

### Plastic and Glass Tubes Provide Means of Transporting Alfalfa-Pollinating Bees

Researchers have found small plastic or glass tubes promising as a commercial means of transporting and establishing alkali bees and other important bee pollinators of alfalfa grown for seed in many parts of the world.

Adequate populations of pollinating bees are needed to assure seed production in areas where agricultural practices have reduced natural populations by destroying the bee habitats.

Use of tubes for shipping and establishing bees was devised by Dr. George E. Bohart, entomologist of USDA's Agricultural Research Service, with the cooperation of Utah Agricultural Experiment Station scientists at Logan.

In their experiments, the scientists placed one mature alkali bee larva in each sterile 5/16 by 2-inch tube. Larvae were first dipped in a liquid fungicide as a precautionary means of preventing spread of bee diseases. Cotton to allow ventilation and absorb excess moisture was used to plug one end of each tube and honeycomb wax was used for the other.



## RETAIL MARGINS

(Continued from page 52)

Many of the affiliated stores, because the buying group was a cooperative organization, received a refund from the purchase price when items were purchased from the wholesale cooperative. When this was taken into account there was little difference between independent and affiliated stores in the purchase price of the commodities studied.

### Spoilage and trimming waste

The fresh produce department of a store is a relatively high risk department because of the highly perishable products which are handled. The markup on a commodity will, to some extent, be governed by the expected waste loss on it. Lettuce had the largest waste of the commodities studied. Bananas and grapefruit had the least waste. The difference among the type of stores in the over-all percentage of waste on all commodities was negligible.

### Retail price

One of the factors which consumers consider in deciding on a place to buy groceries is price. However, few consumers shop at more than two stores and most only shop at one store during any given week. As a result it is the consumers' conclusions of level of price which influence the decision of where to shop. For the seven commodities included in this study the chain stores had, on the average, the lowest prices, although they did not have the lowest price on tomatoes, apples, or grapefruit (table 2). However, the variation in price among the three groups of stores was not great enough to be really significant.

### Quantity of produce sold

Chain stores sold a much larger volume per store of every item included in this study than did the other types of stores while affiliated stores sold more of each commodity

Table 1. Wholesale purchase price per pound of seven fresh produce commodities, related to type of store, 156 grocery stores, Utah, spring 1959

Commodity		Independent	Affiliated	Chain
Number of stores		58	58	40
	unit	cents	cents	cents
Lettuce	pound	5.4	5.7	3.4
Tomatoes	pound	15.6	15.8	15.5
Apples	pound	10.4	10.5	10.3
Strawberries	cup	25.5	25.4	24.6
Oranges	pound	9.1	9.1	9.2
Grapefruit	pound	8.6	9.0	8.6
Bananas	pound	15.1	15.0	14.8

Table 2. Retail sales price per pound of seven fresh produce commodities related to store type, 156 grocery stores, Utah, spring 1959

Commodity		Independent	Affiliated	Chain
	unit	cents	cents	cents
Lettuce	pound	15.0	17.8	12.5
Tomatoes	pound	23.2	21.9	25.3
Apples	pound	17.4	17.4	17.9
Strawberries	cup	29.5	27.6	27.5
Oranges	pound	13.7	13.9	12.6
Grapefruit	pound	12.4	14.1	12.4
Bananas	pound	18.9	18.7	17.6

Table 3. Markup on seven fresh produce commodities related to store type, 156 grocery stores, Utah, spring 1959

Commodity	Independent	Affiliated	Chain	Average all stores
	percent	percent	percent	percent
Lettuce	61	65	50	59
Tomatoes	31	21	34	28
Apples	39	40	41	40
Strawberries	13	7	10	10
Oranges	31	21	29	27
Grapefruit	28	35	28	30
Bananas	20	20	16	19

than did independent stores. In both independent and chain stores a larger volume of bananas was sold than any of the other six commodities; volume of oranges was second, while in affiliated stores more oranges were sold and bananas followed in second place. Apples had low sales in all three types of stores, but at times out-sold strawberries and grapefruit on a volume basis. The study was made near the end of the apple marketing season and the orange and grapefruit seasons were past their peak. The new season for tomatoes and strawberries was beginning.

The highest margin was taken on lettuce averaging close to 60

percent (table 3). One of the important reasons for this was the large waste with lettuce. This waste, of course, was mostly trimming waste, not spoilage. The second highest margin was on apples with about a 40 percent markup. The waste on apples was not excessive, only in the neighborhood of 5 to 6 percent as compared to 20 percent on lettuce. Apples were usually not refrigerated. The markup on oranges and grapefruit averaged 27 and 30 percent, respectively.

The markup on strawberries was usually lowest. They were often used as price specials, and because of the time of year were in rather abundant supply.



## Conclusions

Retail stores are concerned about the price margin for the whole store or for a particular department, such as grocery, meat, or produce, but they are little concerned about the margins on individual commodities. Price specials near or at below cost will be used if they will help sell some other item with a regular markup. Consequently one cannot expect the margin on a particular item such as lettuce to reflect accurately the cost of handling that item. The margin on a particular product may be either excessive or less than enough to cover the cost of handling that product as long as the total store margin is maintained.

In the present study the biggest percent markup was taken on lettuce. This was about double the average markup on the seven produce items included in the study. It amounted to 10.3 cents per pound. The large amount of waste was one of the important factors in determining this.

The markup on apples was next highest—about 40 percent or 7.2 cents per pound while the markup on oranges was only about 27 percent or 4.3 cents per pound. The spoilage on these two items was about the same and it is difficult to determine the reason for the difference in markup. If markup for the two commodities was to be made equal on a cents per pound basis the percentage markup on apples should actually be lower than the markup on oranges because retailers did pay a little more for apples than for oranges.

### APPLE JUICE

(Continued from page 47)

In 1947 in the United States experiments were carried out with ascorbic acid in the production of a stable unclarified sweet cider. A small amount of ascorbic acid could be added for the anti-oxidant effect only. No claims could be made for a nutritional value under this condition. Or, a large amount (6 to

Table 1. Comparison of the nutritional value of apple cider and orange juice

	Cal- ories	Pro- tein	Total carbo- hydrates	Cal- cium	Iron	Thia- mine	Ribo- flavin	Nia- cin	Vitamins	
									A	C
		gm	gm	mg	mg	mg	mg	mg	I.U.	mg
Sweet apple cider	53	Trace	14	6	0.5	0.02	0.03	Trace	38	0.2- 3.6
Orange juice	47	0.9	12	11	0.4	0.07	0.02	0.3	212	9.7-70.0

(Data taken from Food — The Yearbook of Agriculture 1959, except the last column which was taken from the source of figure 1 of this article.)

12 grams per bushel of fruit) of ascorbic acid could be added for both anti-oxidant and nutritional effects. With a 50 percent efficiency, this would leave 25 - 50 milligrams vitamin C per 100 milliliters of juice. Various experimenters were successful in adding the ascorbic acid (1) as a spray to the fruit before crushing, (2) as a spray to the pulp in the cheeses, or (3) with a metering pump in the juice line while it was being transferred from the tank below the press to the holding tank.

Some juice manufacturers tried selling this fortified apple juice for a year or two but discontinued it because the public would not pay the small increase in price necessary for the product with the greater nutritional value.

Within the last few years, interest in fortified apple juice has revived. This has been a result of pressure by such organizations as the National Apple Institute, the International Apple Association, and the Washington State Apple Commission to find methods of selling apples and apple products in the face of the tremendous increase of citrus sales and advertising. This latter group stresses the nutritional value of its product, especially the vitamin content.

Cornell University and Michigan State University are currently experimenting with fortified apple juice.

In 1959 at Utah State University, experiments were begun with ascorbic acid (vitamin C) and sweet cider which have resulted in the production of two new (for Utah) apple juice drinks. The first drink

looks much like the standard sweet cider, has the vitamin C content equal to that of canned, unsweetened orange juice, and tastes much like the standard sweet cider. The second drink had a vitamin C content equal to that of canned unsweetened orange juice but has the flavor of a fresh apple and is much lighter in color than the standard sweet cider.

This light colored apple juice is produced by adding ascorbic acid to the juice as it leaves the press (see fig. 6). It is then clarified with Pectinol A, filtered, and pasteurized similar to the method used with standard sweet cider. Sufficient ascorbic acid is added (about 70 milligram per 100 milliliters) so that the finished product will have 40 milligrams per 100 milliliters.

### Chemistry of apple juice darkening

The juice within an apple is light colored — almost white, but will darken within an hour as it is handled after being pressed from the fruit. This is caused chiefly by the action of the enzyme polyphenol oxidase on the catechol and pyrogallol in the tannin of the juice in the presence of air. The addition of ascorbic acid (vitamin C) to the light colored juice immediately upon pressing inhibits the darkening process by combining with the oxygen present. Stirring, shaking, or pumping the juice in the presence of air "uses up" the ascorbic acid and when that occurs, the juice will darken.

Analyses have been made of the fortified apple juice for ascorbic





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acid content. The preliminary results may be summarized as follows:

1. Each handling of the juice in which it is stirred, poured, or pumped before pasteurization causes a decrease in ascorbic acid.
2. Under the conditions of our manufacture, it was necessary to add ascorbic acid at the rate of 70 milligrams per 100 milliliters as shown in fig. 6 so as to have 40 milligrams per 100 milliliters as shown in the light colored juice in fig. 7.
3. Pasteurized, fortified juice from which air is excluded stored either cool (35°F.) or warm (90°F.) for a two month period loses little ascorbic acid.
4. As soon as the fortified apple juice is exposed to air it begins to lose ascorbic acid at the rate of 1 to 4 milligrams per 100 milliliter per day depending on the amount of air mixed with the juice.

This new product is a worthwhile addition to the series of drinks which have been developed at the Utah State University during the past few years.

#### *Chemical preservatives for apple juice*

Benzoate of soda has been used commercially for many years as a preservative for apple juice. However, the objectionable flavor of this additive can easily be detected.

Studies have been conducted at

Utah State University since 1954 using sorbic acid and sodium benzoate as preservatives. It was found that sorbic acid is more effective against yeast growths and subsequent alcoholic fermentation in apple juice.

It was found that the concentration of 0.05 percent of sorbic acid or potassium sorbate in combination with "mild pasteurization" ex-

tended the refrigerated life of apple juice by a month.

"Mild pasteurization" is the term used to describe the process of heating the raw juice to 170°F., cooling immediately (with a milk cooler) to 100°F., adding Pectinol A for clarification, allowing to stand 12 - 15 hours at ambient temperatures for settling, decanting the clear juice into 1 gallon bottles, and storing at 35°F. with no further preservative treatment.

The advantage of the use of potassium sorbate is that this chemical is completely soluble in the apple juice whereas sorbic acid is not.

This pioneering research work conducted on the USU campus was further explored extensively by the Eastern Utilization Research Laboratory, Philadelphia, Pennsylvania. Sorbic acid has recently been cleared by the Food and Drug Administration as a safe food preservative.

### CONTRIBUTIONS TO RESEARCH

February 1 to May 6, 1960

Moroni Feed Company	\$5000 for studies on synovitis of turkeys
Hess and Clark	\$5,000 for studies of trichomoniasis, coccidiosis, and other parasitic diseases of livestock
Turkey Marketing Board	\$3000 for turkey nutrition studies at Snow College
Upjohn Company	\$2000 for studies on synovitis of turkeys
Dawes Chemical Company	\$1500 for study of high energy locally grown feeds for poultry
Shell Chemical Company	\$1500, dieldrin, endrin, phosdrin, and aldrin for insecticide studies
Abbott Laboratories	\$1200 for studies on synovitis of turkeys
Ogden Grain Exchange	\$1200 for wheat breeding studies
National Plant Food Institute	\$1000 for fertilizer trials
Campbell Soup Company	\$800 for cultural studies with tomatoes
Stauffer Chemical Company	\$500 and 40 pounds Trithion W. for insecticide studies
Velsicol Chemical Company	\$500, heptachlor, chlordane, and endrin for insecticides studies
Allied Chemical Corporation	Genite 923, 4 gallons, for insecticide studies
California Spray Chemical Corporation	Tedion, supreme oil, dibrom for insecticide studies
Geigy Agricultural Chemicals	Diazinon W. and chlorobenzilate, 96 pounds, for insecticide studies